RAILROAD GAZETTE

FRIDAY, APRIL 22, 1904.

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Contributions

Is Not a Yard Engine a Train?

Chicago & North Western Ry.,
Winona, Minn., April 10, 1904.

To the Editor of the Railroad Gazette:

I have been reading the article from an officer of the C., C., C. & St. L. Railway in your issue of March 18, wherein it is stated that the conductor and engineer of the Purdue special were entirely at fault for the collision at Indianapolis last October, they having violated the yard-limit instructions.

Notwithstanding this authoritative utterance, some train despatchers object strongly to the reasoning presented in the article; and a number of them in this vicinity would consider it a hazardous precedent to run an extra passenger train over any part of their territory with right over all trains, without first obtaining the signatures of all trains on the road, and all which are to start within the time included in the extra schedule, including yardmasters and foremen in charge of yard engines. Are we to decide the question of safety in this matter on the fine technical point whether the yard engine does or does not display markers? If so, surely safety requires that the committee of the American Railway Association on train rules modify the rule so that yard engines shall be included in the term "train." The rule should then say that all kinds of motive power occupying the main line shall carry the symbol of a train. This would put all doubts at rest. In creating a special passenger train the despatcher is the king bee on his own pike, and it is up to him to cover all terminals, junctions and ends of double track, and all stations where yard engines are located. He should place at all necessary offices copies of the schedule order, these copies to be signed by conductors of all trains, including yardmasters and foremen of yard engines. Yard engineers habitually clear regular passenger trains, and if such a train is late they demand orders to use time on the delayed train. Safety demands that all special passenger trains be accorded equal rights with first-class passenger trains. When this is done there will be no doubt as to the rights of a special passenger train.

R. A. WATTS.

Enforcement of Train Rules.

To the Editor of The Railroad Gazette:

I have read with great interest the article of Mr. H. W. Forman in your issue of April 8. Truly, as he says, we must look beyond the train-order problem to discover the true cause of most of our collisions. He outlines these ulterior causes from one standpoint; but he did not exhaust the subject, of course. Doubtless he feared to exhaust your readers, for the whole story would be a long one. It has occurred to me that you and Mr. Forman and the gentle reader might like to rest your weary mental eyes by looking at this question for a moment through the eyes of a stranger. The president of a great railroad system on the island of Borneo once on a time put the standard rules into effect and then dismissed the matter from his mind. But he failed to derive any benefit from the new rules and he hied himself to America. He came here to investigate. He found that our despatchers were not permitted to read newspapers or books while on duty; that they had quiet offices to themselves and were required to perform no clerical service. The chief train despatchers carefully checked all train orders and would not retain men in service who would not conform to the prescribed forms and other rules instructing how orders should be filled out and delivered. Such precautions were not thought necessary in Borneo. He took a trip over an American road; his train made an unusual stop and the flagman immediately went back to protect, even before the engineman had had time to whistle him back. This seemed unnecessary, as he had been informed that there would be no train to follow for some hours. In Borneo flagmen used their own judgment and did not protect under such circumstances, or when they thought their train could be plainly seen by following trains. Upon approaching a telegraph station this Oriental president observed a semaphore order signal fully 25 feet above the rail and so placed that its indication could not be hidden by the water tank; and there was a duplicate indication lower down, about on a line with coach windows, to enable passenger men to positively ascertain whether the signal indicated stop or proceed. The siding was built on the outside of the curve and extended far enough beyond the order signal to enable a train to stop in time to prevent it from colliding with an opposing train in case of miscalculation.

The operator seemed to have plenty of time to attend to train orders, and Mr. President noticed a book lying upon his table which proved to be a very complete examination and explanation of the rules and other instructions for operators, advising and warning them of many traps that men had thoughtlessly been drawn into. This was indeed a surprise, as, in Borneo, such information was kept locked up and no one, except officials and examiners, were permitted to consult it, lest it be learned by rote. He also recalled that he had permitted a farmer boy of six months' experience to take charge of one of his small offices on the assurance of the agent where he was taught all about the business that he was a good boy and that his parents were among the foremost people in the county. Had this boy been permitted to study such a book the accident which he was afterward responsible for might have been averted. The president remembered also that this boy was especially recommended as being qualified to do the work at a "small office," but he concluded now that failure to deliver or understand a train order at a small office might be attended with the same results as elsewhere.

Again, about sunset, his train stopped in a dense fog. The flagman immediately went back with a red and a white lantern, torpedoes and red fusees, and he was surprised to note that the fusee could be seen burning so far under such conditions. He could see it away back there long after the lanterns had disappeared from view. A train was heard approaching and a torpedo was exploded and answered by two short blasts of the engine whistle. This seemed to him like a waste of money, as the fusee could be plainly seen, until he recalled a case in Borneo where the visible signal was not respected because the engineman was asleep and the never-failing method of attracting attention by throwing the lantern through the cab window had proved ineffectual for once on account of the flagman's aim being inaccurate. It seemed odd that the engineman should answer the torpedo signal, but on reflection he saw that Rule 29 required it.

When he reached his destination Mr. Borneo got into conversation with the conductor and engineman of the train and began to question them. He noted that there was but one understanding of rules among them and that employees generally were able to repeat many of the rules verbatim and could explain very clearly the meaning of all of them. He was also informed that every despatcher, operator and train employee must pass an examination upon the rules, lasting a full day, and that until this was done certificates would not be given them, and that these certificates were good for only one year. The ordeal had to be gone through with once a year. Examinations were conducted by a board of examiners who were regularly employed to perform that service, and who were in close touch with the management. The men on this board also passed over the lines of the road regularly to see that their instructions were being followed and to ascertain whether any unsafe practice was in vogue that might eventually cause an accident.

This president then knew why there were so many accidents in Borneo, and so very few in the United States.

But, it will be said, these suggestions involve a considerable outlay.

Yes; and accidents also are expensive.

SARAWAK.

Terminal Cleaning of Passenger Cars.*

An important point to the car cleaner is the character of the yards in which the cars are cleaned, and in this he is dependent upon the Maintenance of Way department. There are a few yards which are suitable for this purpose, but the idea seems to prevail at many terminals that cars can be cleaned anywhere, regardless of the conditions existing between the tracks, or the close proximity of passing trains. A suitable yard is one having sufficient standing room for all the cars to be cleaned, situated on land that can be easily drained and so located that there is no danger whatever from passing trains. It should be equipped with steam, water and air-pressure pipes throughout; also suitable racks for cleaning carpets, cushions, mattresses, bedding, etc., with facilities for conveying them to and from the racks. Suitable buildings should be provided for the storage of material and tools, and rooms for the comfort of employees, containing clothes lockers and lavatories. A shed large enough to cover two or three cars is a great help in bad weather, but this is not an absolute necessity.

Another point of vital interest is the movement of equipment to and from the yards. Co-operation between the Transportation department and the car cleaner is needed at all times in order to insure results that will be entirely satisfactory. He depends upon this for his regular supply of work, for sufficient time in which to do it properly, and the systematic handling of his forces. Without prompt and regular movement of cars, the cleaners lose time awaiting work; as a result of this the cleaning is then hurried, and done in a slip-shod manner. Furthermore, there can be no systematic organization of the cleaning forces. There are, of course, unavoidable delays caused by the lateness of trains, for which there is no remedy. Nothing is gained, however, by holding three trains in the station which arrive on time for the fourth train when it is late, so that all may be pulled to the yards together, especially if this manner of handling the trains deprives the cleaners of the necessary time in which to do their work properly. It is preferable to get the three trains at the usual time and keep the force regularly employed.

The work of cleaning is somewhat more complicated than one unacquainted with the subject would suppose. In the first place there is a great variety of cars to be cleaned; postal, baggage, express, horse, passenger, combination, parlor, dining, cafe, sleeping and special cars, all of which require somewhat different treatment. Some have carried emigrants and others the most refined travelers, and the cars which have carried the former are sometimes wanted for the latter on short notice. They have made trips varying from ten to over 1,000 miles in length, and through sections of country differing widely from each other in respect to geographical conditions. Each section has its own peculiar effect on the equipment. In mountainous regions this is most apparent in the form of soot and smoke, also sweating, where tunnels exist, on account of extremes of temperature. In sandy districts and in the prairie country it is apparent in the form of dust. In addition, there is rain, sleet, ice and snow to consider, for cars must be cleaned, regardless of the weather.

From these varying conditions it can readily be seen that rules governing the cleaning must necessarily be more or less elastic. With this in mind, the general requirements for cars which have made short trips, less than 100 miles in length, are as follows:

Interior.—Raise some of the windows when the state of the weather permits, in order to admit fresh air; remove rubbish; sweep floor and carpets; clean up anything offensive; wash and disinfect closets; clean washstands; dust seat cushions and backs, sills and seat arms; set the window shades to a uniform height, and do any light cleaning necessary to put the car in serviceable condition.

Exterior.—Remove anything offensive from the body and trucks; sweep platforms and steps, and wipe the hand rails.

Once in each 24 hours when making short trips, or when the aggregate mileage of several short trips exceeds 100 miles, also, when continuous trips have been made exceeding 100 miles in length, cars should receive a thorough cleaning, as follows:

Interior.—Raise windows and open doors, when state of the weather permits, to admit fresh air; remove carpets; dust window shades, seat cushions and backs, ceiling and woodwork; sweep and mop floor; clean washstands and metal work; sponge off window sills, seat arms, foot rests, pipe covers, hopper tops and the lower wood work in toilet rooms with water containing disinfectant; wipe partitions, prominent parts of wood work and interior of wide vestibules where necessary; clean and replace carpets; clean glass and mirrors; set window shades to a uniform height and do any further cleaning necessary to put the car in serviceable condition.

Exterior.—Wipe or wash outside body, sash and doors; clean window glass; sweep and wipe platforms, steps and hand rails; wipe trucks, side truss rods, boxes, etc., and polish the brass.

In addition to the above two classes of cleaning, special work which is not necessary at the end of every trip must be done at intervals. The water coolers must be cleaned out occasionally and the dust removed from the window openings, curtains, seat cushions, backs, etc. The ceilings and interior wood work require washing and the outside of the body and trucks need scrubbing at intervals to remove the accumulations of soot and dirt which is not wiped off by the regular cleanings. It is a hard matter to lay down general rules stating definitely how often special cleaning should be done. In the summer time, for instance, when the windows are raised and the ground is dry and dusty, the seat cushions and backs require more attention than they do in the winter months. On mountainous divisions the car ceilings, interior finish and outside bodies require more special cleanings than similar cars running through open country. Much depends upon

*Extracts from a paper by J. D. Wright, Foreman of Painters, B. & O., read before the Railway Club of Pittsburg, March 25, 1904.

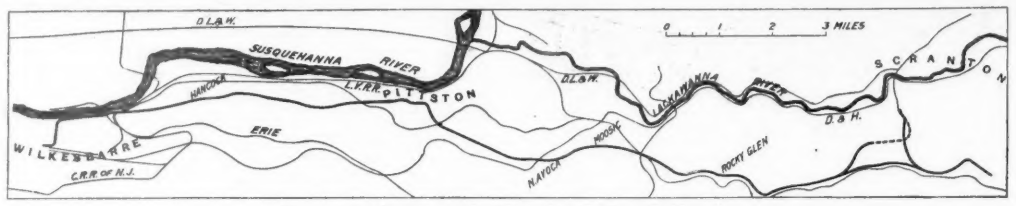
the climatic conditions, the character of the country through which the cars run, and the mileage.

The use of compressed air for cleaning curtains and cushions is a great improvement over hand-beating and brushing, as it does the work more rapidly, and, at the same time, more thoroughly. It is also useful in blowing the dirt out of window openings, corners and places which cannot be reached easily by other methods. It does not, however, dispose of the dust, but merely blows it from one place to another, and its second resting place may be as objectionable as the first. This bad feature of compressed air cleaning is entirely overcome by the use of a vacuum system having sufficient power to draw the dust to a place where it can do no harm. From the small amount of study I have been able to give this system, it seems to be a great improvement over all other methods now in use, particularly for cleaning curtains, carpets, cushions, etc.

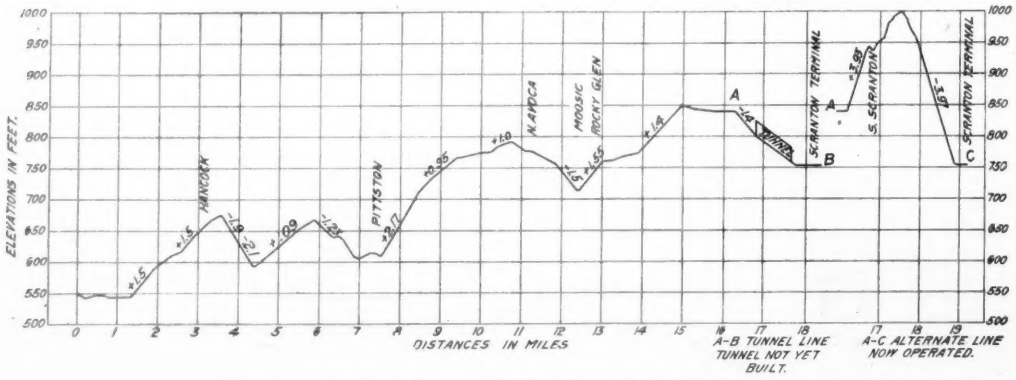
The best material for washing interior ceilings and wood work is neutral soap and water, applied and washed off with a sponge and dried with a chamois skin. A slight gloss is imparted to the surface of the varnish by the use of an oil soap.

Perhaps the most difficult problem connected with car cleaning is the special scrubbing of exterior bodies, for the purpose of removing the accumulation of soot and dirt. The old-time method of washing with soap and water has been superseded in recent years by the use of ready-prepared car cleaners, a large number of which are on the market. Most of these are emulsions having an alkali, acid or abrasive powder as the cleaning agent, with the addition of an oil to prolong the life of the varnish. The efficiency of these cleaners depends largely upon the energy of the workmen, but when handled intelligently some of them give very good results. This seems to be the most popular method of cleaning exteriors at the present time, and has been adopted by a large number of railroad companies.

An oxalic acid solution is also used somewhat for exterior cleaning. Its action on soot is rapid, but it will not remove oil or grease; furthermore, it has the serious objection of leaving the surface dull, due to the crystallization of the acid. The solution does not destroy the life of the varnish, and is used with some degree of success over light colors, when oil and grease are not present.



Map of Lackawanna & Wyoming Valley Railroad.

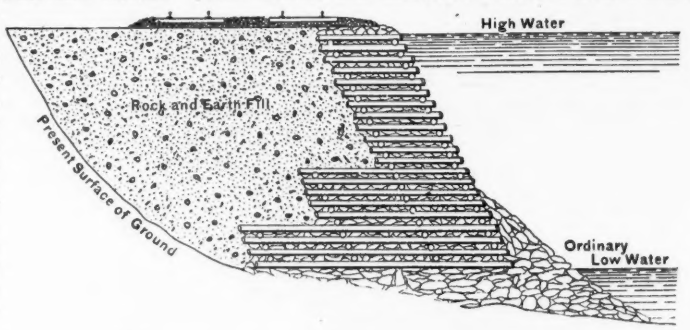


Profile of Grade Between Wilkes-Barre and Scranton.

as the southern, middle and northern anthracite coal fields of Pennsylvania are the only anthracite coal fields deserving of mention in the United States, and the demand for this coal comes from all points of the compass. The area of these fields is the equivalent of a tract of land 22 miles square. These coal measures were once horizontal and bituminous, but the volatile elements of sootiness and gas have been driven off under the great heat and pressure to which they were subjected when the Allegheny Mountains were uplifted. This coal was discovered between 1770 and 1790, at the time of the Revolutionary War, by a party of hunters, but was not mined until 1807, and mining was not developed as a trade until 1820. The northern coal field extends from Carbondale, on the northeast, to Nanticoke, on the southwest, 50 miles. At Carbondale, the coal lies near the surface, and at Nanticoke, in some veins, as deep as 1,800 ft., and there is yet much coal to be mined. Scranton and Wilkes-Barre lie 20 miles apart, near the center of the coal fields. These cities, together with the intermediate territory, provide a population of upward of 200,000 people adjacent to the railroad to be described.

The railroads which have been built to and through these valleys are as follows: the Lackawanna, Lehigh Valley, Erie, Delaware & Hudson, Ontario & Western, Central of New Jersey and the Pennsylvania. This explanation of the railroads and coal measures is necessary as a preliminary to show why the Lackawanna & Wyoming Valley Railroad was so expensive to build and why it required so many different kinds of structures.

The railroad was built under steam-railroad charter and extends from Wilkes-Barre to Scranton, 20 miles. It is a standard-gage, double-track, rock-ballasted, third-rail electric road on a private right of way throughout its length, laid with 90-lb. rail. The line was opened for business from Scranton to Pittston in May, 1903; from Pittston to Hancock in September, 1903, and from Hancock to Wilkes-Barre in December, 1903. Later on the road will probably be extended to Carbondale. The railroad enters Scranton by a temporary location, known as the Erie cut-off, with steep grades (4 per cent.) over a hill that is to be pierced by a double-track tunnel. Except on the temporary cut-off above noted, and at the terminal loops in Scranton and Wilkes-Barre, used only for passenger service, the alinement is within the limits of good practice for steam railroads of the first class. With the exception of the temporary cut-off above noted, the profile of grade line of the track is as good as those of the steam railroads in the same mountain region, the maximum rate being 2 per cent. The track, including rails, ties, ballast and switches, is of first-class standard steam-railroad construction; in fact, equal to the best existing construction. In addition to the passenger service, it is intended that the road shall serve as a freight road for the interchange of bulk freight between the steam roads entering one end of the valley and not reaching the other, of which there are several. Beginning with the terminal station at Wilkes-Barre, the physical characteristics are described as follows: The Wilkes-Barre Terminal is in the heart of the city, on the opposite side of North Market street from the Union Station of the various steam roads. Here is a capacious terminal passenger station building, costing in the neighborhood of $50,000; also freight house and freight yards. The tracks lead out of the city by way of the old Pennsylvania & New York Canal and Railroad Company right of way, purchased and leased from the Lehigh Valley Railroad, to the bank of the Susquehanna river. The Susquehanna river at this point has a rise and fall of about 30 ft. Owing to the other railroads having in a large degree pre-empted the river bank, it was necessary to locate the new double-track railroad well out toward the low water line, save at certain rocky points. The construction of a plain embankment at these places involved two undesirable features: first, a slope, extending too far out into the river, and in a manner liable to meet with objections; second, the necessity of securing a large amount of material, not readily available at low cost, until the completion of the road. A timber trestle was out of the question, as it would have to stand in the water at flood height, while heavy ice was running in the river. A masonry wall was very expensive, and its foundations somewhat uncertain. It was finally decided to construct three round-timber cribs, each about 600 ft. long and with maximum heights of about 30 ft. The bases are founded either on shelves cut into the river bank or in riprap dumped into the river to above the low-water mark. The pockets are 7 ft. square, and are filled with riprap. The round logs are drift, bolted at each intersection. Hemlock, spruce, pine and some hard woods have been used. It was difficult to obtain the large quantities at the proper times, and some of it had to be brought from as far away as Virginia. It was also troublesome to obtain suitable stone for the riprap. Here, again, it was necessary to go considerable distance for material, as the rock available in the immediate vicinity is an inferior

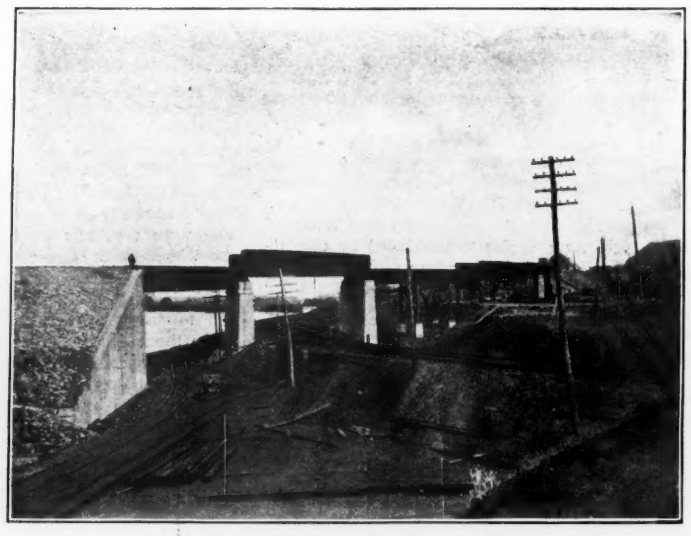


Typical Cross-Section of Crib, Susquehanna River.

The Lackawanna & Wyoming Valley Railroad.*

This project was conceived in 1900 by parties having interests in the northern anthracite coal region, who believed that there was need of better freight and passenger service for the local requirements, and that a first-class interurban electric railroad from one end to the other of this coal field would prove to be a good investment. The Lackawanna Valley, in which flows the Lackawanna River, a branch of the Susquehanna River, is a continuation of the Wyoming Valley, in which flows the Susquehanna River, the latter river breaking through the northern boundary ridge of the valley at Pittston, a point near the center of the coal measures. These valleys are in the Allegheny Mountain region of the northern part of the State of Pennsylvania. The three coal fields known

Timber Brattice Work in Swoyer's Hill Cut.



Viaduct Near New Prospect Breaker.

* Extract from a paper read by Geo. B. Francis, M. Am. Soc. C. E., before the Boston Society of Civil Engineers, on January 14, 1904, and published in the March number of the Journal of the Association of Engineering Societies.

anthracite mine rock, called "gob," which disintegrates upon exposure to weather.

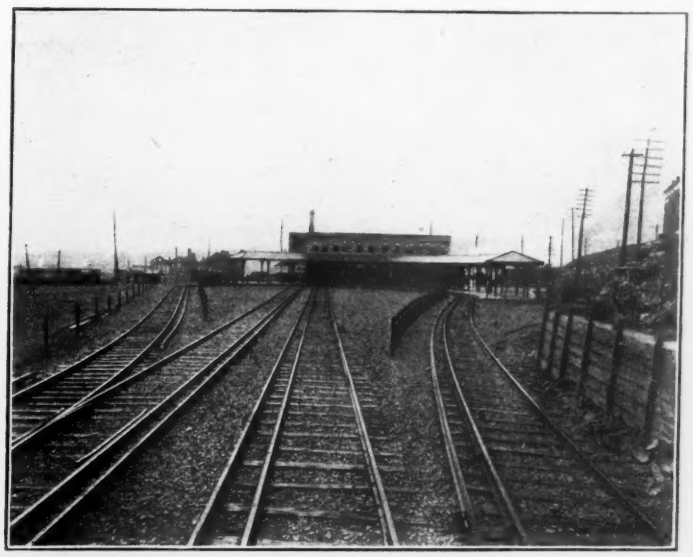
Mill Creek Bridge, at the Wilkes-Barre city line, has been built in several spans, supported on concrete masonry, according to the terms of the right-of-way agreement. The tracks then pass under a bridge span of the Wilkes-Barre & Eastern Railroad, which bridge span has been entirely rebuilt to give sufficient head room. Near the New Prospect Breaker a viaduct has been constructed, 554 ft. in length and about 800 tons weight, to carry the road over the two Harvey's Lane branch tracks, the four main tracks of the Lehigh Valley, the mine tracks of the Lehigh Valley Coal Company, the highway upon which is the track of the Wilkes-Barre & Wyoming Valley Traction Company, and the three tracks of the Central Railroad of New Jersey. At this point a mine-opening bridge has been built for the relocated highway. Various retaining walls and pipe subways have been built here; also a pump house and gas-tank building have been relocated and built. At Swoyer's Hill cut it has been necessary to build timber brattice work on both sides of the cut for 900 ft. to keep the blue clay from sliding on to the track. The timber struts extend under the tracks from side to side each 5 ft. A viaduct about 600 ft. long was built at Avoca over the tracks of the Lehigh Valley and the Delaware & Hudson, a highway and a street railroad. This viaduct was for the purpose of crossing from one side of the ravine to the other. It contains about 1,300 tons of steel. Near this place, as well as at several others places, it was necessary to go into the mine workings and built masonry to support the abutments of bridges where the roof of the mine was so thin that there was danger of its caving in. At Spring Brook, Moosic, two bridges have been built to carry the tracks over a highway, a branch railroad and Spring Brook.

The passenger station at Scranton is a brick building which has cost about $50,000. It contains the main offices of the company and is located near the center of Scranton. The terminal site contains about 100 acres and was formerly the location of the north works of the Scranton Iron and Steel Company, now removed to Buffalo. The passenger station has a loop track of 60 ft. radius, the same as at Wilkes-Barre.

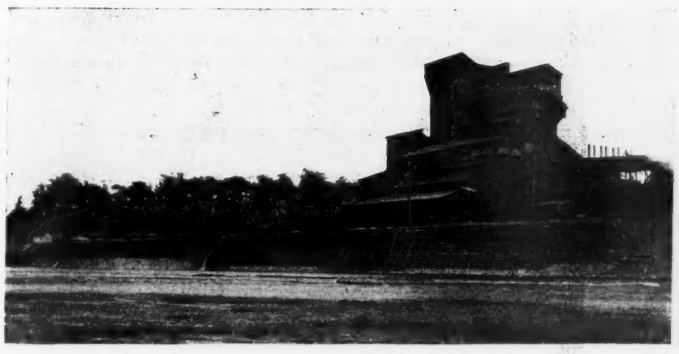
The problem of securing terminal lands in the heart of Scranton, Pittston and Wilkes-Barre, as well as securing right of way through the coal lands and workings, was one which involved the purchase of several acres of improved property and the exercise of much ingenuity and tact to secure the willingness of the owners to part with their property, and at the same time avoid being compelled to pay extremely high rates. With the exception of the freight and passenger stations at Wilkes-Barre, Hancock, Pittston and Scranton, the stopping points consist of platforms on each side of the tracks, with small shelters. There are no ticket agents excepting at the four places named above. As a rule, the stopping places are at under or over-crossings, and the crossing of tracks at grade and the breaking of the third rail are avoided. There are, however, a fe wexceptions to this rule. Nearly all the masonry required for retaining walls, bridge abutments and culverts has been constructed of Portland cement concrete. The bridges have been built under the specifications known as "Cooper's E 40." On account of the exposure of the live third rail, the entire right of way has been fenced with wire fencing, and trespassing on the same is thereby nearly done away with.

The equipment consists essentially of the following: One locomotive; 10 single-end passenger cars (controller on one end only), divided in the middle for smoking compartment; three single-end combination cars, for passengers and baggage; four single-end express cars, for local package express; 15 double-end multiple-unit cars; 10

Concrete Retaining Wall in Clay Bank.

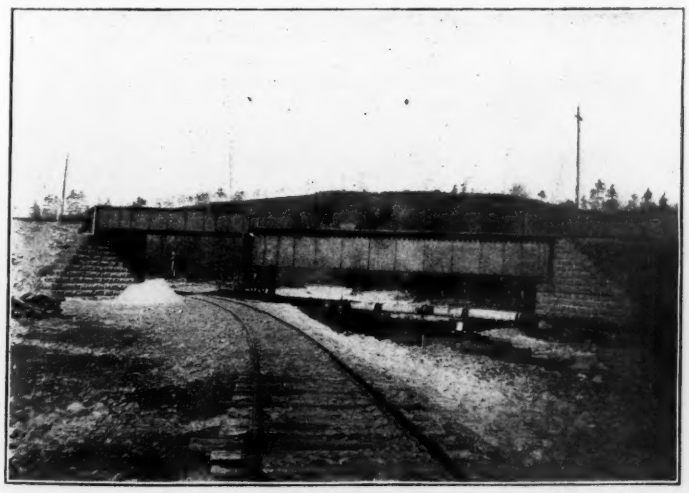


Terminal Tracks at Scranton.



Crib Work Along Susquehanna River.

Rock Cut and Typical Section of Roadbed.



Bridge Over Spring Brook.

Avoca Viaduct.

ordinary box freight cars and a repair car. The passenger cars are electrically heated and lighted, are 52 ft. long over all and have steam railroad trckus, equipped with two 150 h. p. motors.

In Wilkes-Barre there are several grade crossings of streets and for a short distance an overhead trolley is used in place of the third rail, all of the cars being equipped with trolley poles. The contact shoes on the cars are of the gravity pattern, and take the current from the top of the third rail. The road is operated throughout the day on a 20-minute interval between cars, with extra cars morning and evening, which make a 10-minute interval. Special cars, on a five-minute or other interval, are run when required. Multiple-equipment trains will be run as required. The public appreciates the convenience of the road and gives it a liberal patronage. As far as possible, tickets are used, and the general rate is 1½ cents per mile. Cash fares are a little higher.

Westinghouse, Church, Kerr & Company, of New York, have acted as chief engineers, auditors and contractors for the electrical equipment, stations, track work and rolling equipment.

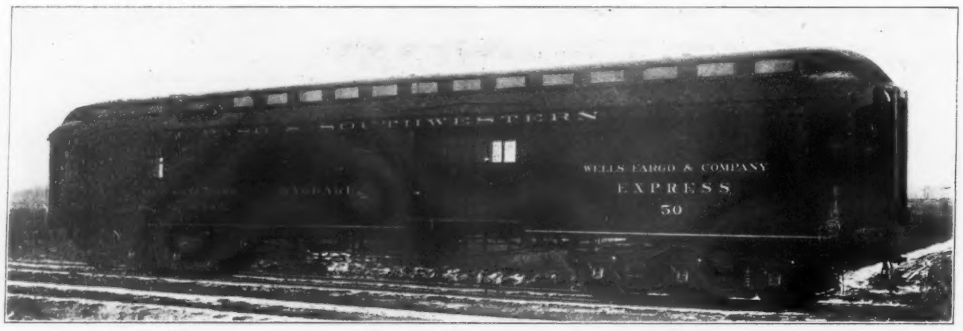
The Security Investment Company, of Pittsburg, Pa., has managed the financial part of the operation. The other principal contractors have been John R. Lee, of Paterson, N. J., for grading, masonry and ballast work: the King Bridge Company, McClintic-Marshall Construction Company and Phœnix Bridge Company, for bridges, and the American Car & Foundry Company, for equipment. The total cost of the road, as far as constructed, including right of way, terminals, grading, masonry, track, power house, electrical workshops, car house, etc., has been nearly $6,000,000. Mr. Charles F. Conn has acted as business manager during the construction and is the Vice-President in charge of operation. Mr. George F. Huggans has been the civil engineer in immediate charge of location, grading, masonry, briding and track work. Supervision of the building work and electrical equipment has come from the office of Westinghouse Church, Kerr & Company, and has been largely executed on the ground by Edward M. Decker. We are indebted to John C. Trautwine, Jr., Secretary of the Association of Engineering Societies, for the cuts shown.

New Passenger Equipment on the El Paso & Southwestern.

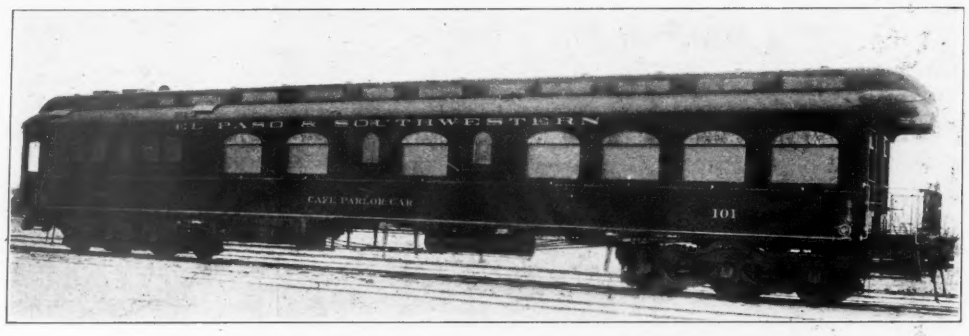
The El Paso & Southwestern has recently received from the Pullman Company three combination baggage and express cars, three combination cafe and parlor cars, and three first-class passenger coaches. These are intended for regular use on the company's lines and are perhaps the handsomest cars in service in that part of the country. The cafe-parlor cars are 70 ft. long over end sills, 9 ft. 8 in. wide and 6 ft. 7½ in. high from sill to plate. They are divided into four compartments. The observation end is used as a parlor car compartment and is 22 ft. long. It contains 18 upholstered rattan movable chairs and the sides are practically all glass, there being four windows 4 ft. 3 in. wide on each side of the car. The observation platform is surrounded with the standard railing and gates and is 3 ft. wide. The smoking compartment has seating capacity for five and is located about in the middle of the car. The toilet rooms are on each side of it and a narrow corridor running around the partition connects the observation compartment with the dining-room. The dining-room will seat 12 persons at a time. It contains two double and two single tables, arranged in a similar manner to the standard dining cars. The kitchen and pantry, which occupy the other end of the car, are quite large and contain all of the necessary storage space for provisions and utensils that is usually provided on a standard dining car.

The passenger cars are 66 ft. long, 9 ft. 8 in. wide and 6 ft. 10 in. high from sill to plate. They are divided into two compartments by a bulkhead 24 ft. 10 in. from one end, so that they may be used for combination smoking car and ladies' coach. There are 24 double seats in the non-smoking compartment and 14 double seats in the smoking compartment, giving a total seating capacity of 76 people. The men's toilet room is located at the end of the smoking compartment and the ladies' toilet at the other end of the car.

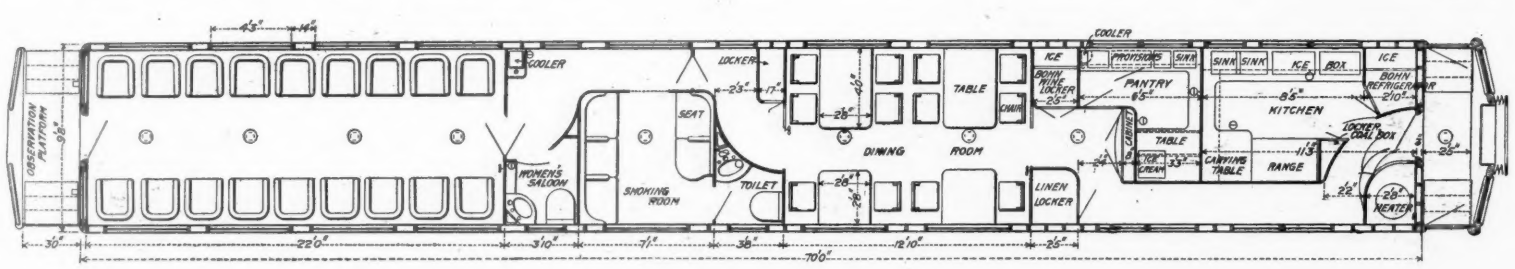
The combination baggage, express and mail cars are 65 ft. 7¾ in. long over end sills, 9 ft. 8 in. wide and 6 ft. 7½ in. high from sill to plate. They have blind vestibules at each end and the mail compartment is partitioned off 16 ft. from one end. The side doors in the baggage compartment are 8 ft. wide, with glass in the upper sash. A narrow door 2 ft. 6 in. wide, for the transfer of mail, is built in each side of the car in the mail compartment. The illustrations from photographs show the general appearance and interior finish of the cafe-parlof cars and combination baggage, mail and express cars. The woodwork is mahogany, richly finished, but without excessive ornamentation. All of the cars are lighted with compressed acetylene gas on the Commercial Acetylene Company's system. They are mounted on Pullman standard six-wheel trucks and are heated with the Pullman double-coil heating system. We are indebted to Mr. George F. Brown, General Manager of the Pullman Company, for the photographs from which the illustrations were made.



Exterior of New Baggage, Mail and Express Cars, El Paso & Southwestern.



Exterior of New Cafe-Parlor Cars, El Paso & Southwestern.

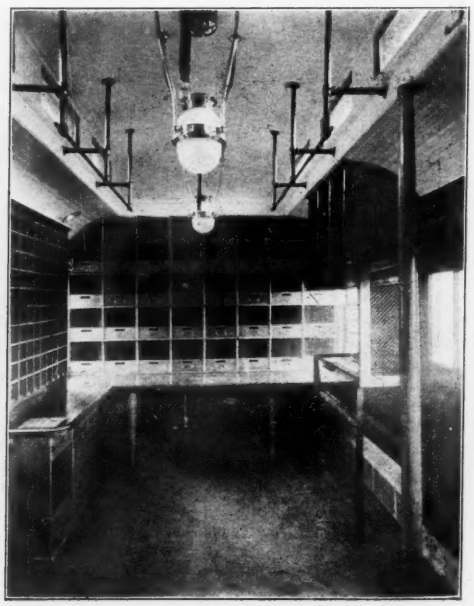


Floor Plan of New Cafe Parlor Cars, El Paso & Southwestern.

A sketch of the progress of the Hungarian railroads from 1891 to 1901 shows an increase of 48 per cent. in mileage (nearly all of which was in local roads), bring-

Interior of Parlor Observation Room.

Interior of Dining Room Compartment.



Interior of Mail Compartment.

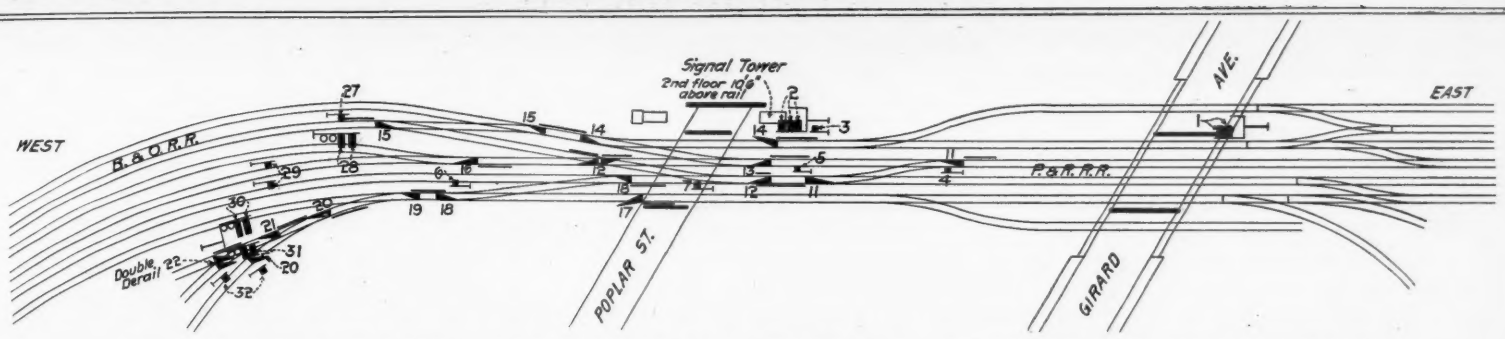


Fig. 7.—Electrically Operated Switches and Signals at Park Junction, Philadelphia, Pa.,—Philadelphia & Reading and Baltimore & Ohio.

ing down the population per mile of railroad from 2,334 to 1,948; in increase of 50 per cent. in capital invested, of 54 per cent. in gross earnings, of 86 per cent. in the number of passengers and of 68 per cent. in the number of tons of freight carried.

All-Electric Interlocking at Park Junction.

The Philadelphia & Reading and the Baltimore & Ohio have lately put in use at Park Junction, Philadelphia, an interlocking plant made by the Pneumatic Signal Company, of Rochester, N. Y., in which all the functions are worked by electric power. The machine has a 32-lever frame, with 25 working levers. Thirteen levers work 21 signals, and 12 levers work 13 switches, 5 derails and 2 movable point frogs. This is the first all-electric machine put up by the Pneumatic Company in the eastern states, the company having only lately completed its designs for this kind of work. Park Junction is where the through

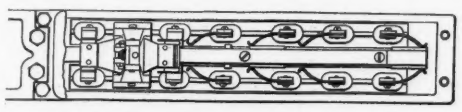


Fig. 2.—Top of Lever.

trains from New York to Washington leave the Reading track for that of the Baltimore & Ohio, and is near Girard avenue station, about 1½ miles north of the Baltimore & Ohio station at Twenty-fourth and Chestnut streets. The arrangement of tracks and signals is shown in Fig. 7. On the Reading tracks automatic enclosed-disk block signals are fixed on the same posts with the junction signals.

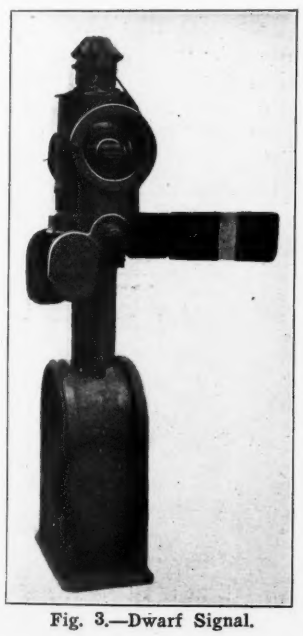


Fig. 3.—Dwarf Signal.

The machine in the cabin is similar in appearance to the pneumatic machines of the same company, and to other all-electric machines. The "lever," shown in Fig. 1, consists of a sliding bar and a fixed iron case, the latter having a projection on the under side for supporting a solenoid which gives the "indication." The fixed portion of each "lever" is 3 in. wide and the levers in a machine are that distance apart, center to center. The fixed portion of the lever contains six pairs of contact springs, as shown in the top view, Fig. 2; and the sliding of the lever, by means of the handle at the left, makes and breaks these contacts at the proper times and in the proper sequence to cause the performance of the different functions of the machine. The two pairs of springs farthest to the right are termed safety springs, their function being to prevent wrong movements in case wires are crossed; the two pairs at the extreme left, fixed vertically, and used in connection with the "walking beam," are the indication springs. At the end of the stroke of the lever the walking beam is quickly snapped from one pair of springs to the other, and its position determines which of the two indicating wires shall energize the solenoid. The main functions of the machine are accomplished by moving the lever so as to make contact with one or the other of the two middle pairs of springs.

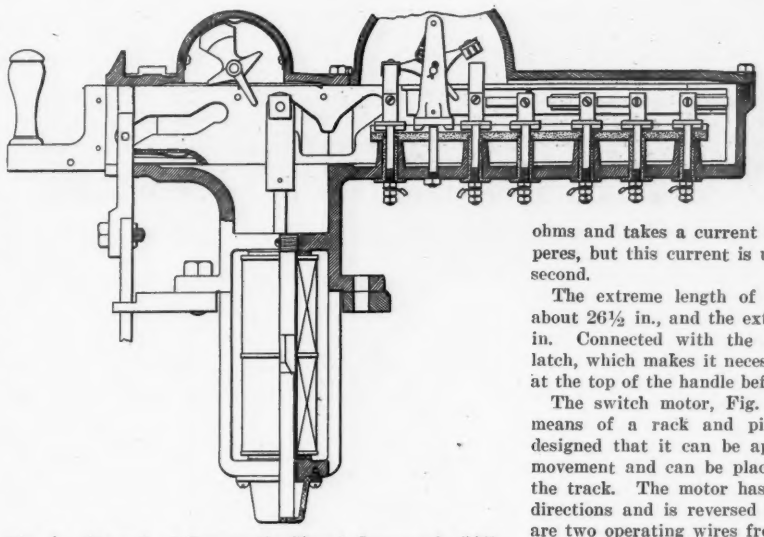


Fig. 1.—"Lever" of Pneumatic Signal Company's "All-Electric" Machine.

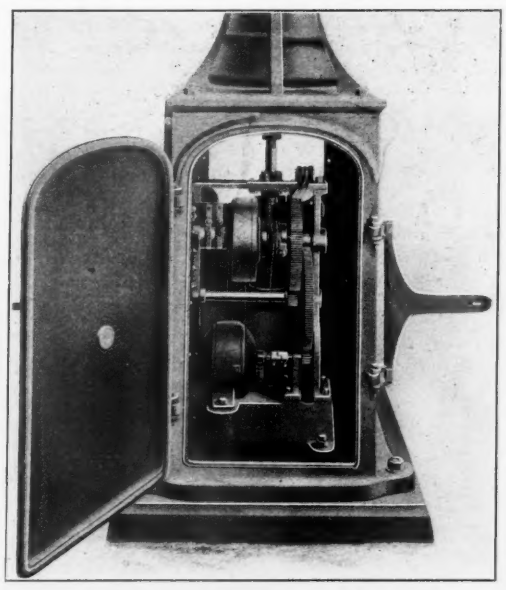


Fig. 5.—Semaphore Signal Motor.

After a switch or signal has been moved the return indication energizes the solenoid, fixed vertically below the Y-shaped slot in the lever, and, lifting its armature, which engages with the slot by means of a roller, forces the lever to the left or right. This is the automatic completion of the stroke. (In the drawing the lever has been pushed to the right.)

A movement of the lever may be traced by examining the function of the Y slot. When the lever is moved to the left, bringing the roller against the straight portion of the slot, the switch or signal has been moved (the suitable contacts having been made), and the lever is in position to be moved still farther to the left by the forcing upward of the roller in the right-hand portion of the Y slot. This occurs on the completion of the movement of the switch or signal, and the stroke of the lever is thus automatically finished. The actuation of the interlocking by means of the vertical tappet, at the front of the machine, lifted and lowered by the smaller slot, is precisely like the similar function in other machines of this kind. The wires from the lever run to a slate terminal board at the back of the machine, where are the necessary fuses.

The indication magnet has a stroke of $1^{3}/_{16}$ in. It moves the lever one inch and is capable of lifting 20 lbs. on the tappet jaw. The magnet has a resistance of 50 ohms and takes a current of slightly more than two amperes, but this current is used only for the fraction of a second.

The extreme length of the lever when pulled out is about 26½ in., and the extreme width of the machine 25 in. Connected with the lever handle is a mechanical latch, which makes it necessary to press down the button at the top of the handle before the lever can be pushed in.

The switch motor, Fig. 6, moves the switch rails by means of a rack and pinion. The mechanism is so designed that it can be applied to any switch and lock movement and can be placed in any position relative to the track. The motor has two fields wound in opposite directions and is reversed by changing the fields. There are two operating wires from the lever to the motor, and no pole-changing switch is used. The indication is sent to the machine by a circuit closer mounted on the switch and lock movement. Two wires are used, one for the normal and one for the reverse indication. They take their current from the common field wire, and the indication springs on the lever, governed by the walking beam, connect the proper wire to the indication magnet. The switch motor is enclosed in a waterproof case, and it rests on a single long sleeper. The commutator is easily got at by removing two tap bolts.

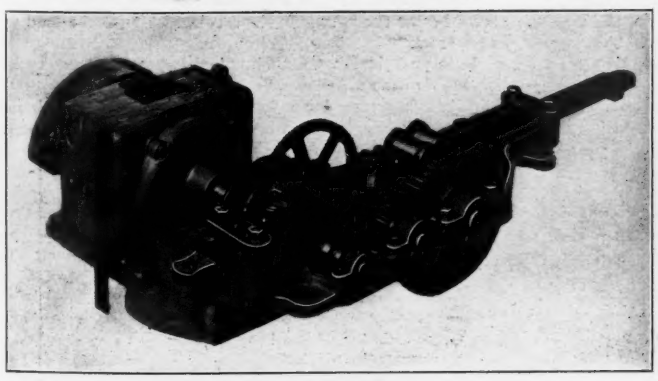


Fig. 6.—Switch Motor.

The semaphore mechanism is shown in Fig. 5. With this mechanism the semaphore arms are locked when in the stop position, the vertical rod having ¼ in. extra travel, which is utilized to lift a locking dog before the rod reaches the position where it is to move the blade. This movement will lift 120 lbs. with a current of .8 ampere.

The dwarf signal, Figs. 3 and 4, is worked by a solenoid with a stroke of 1¾ in. At the beginning of the stroke this magnet will lift 20 lbs. with a current of 6 amperes. The stroke having been made, the magnet will hold this weight with a current of ¼ ampere. The vertical rod moves the blade by means of a roller and jaw, engaging with an escapement jaw.

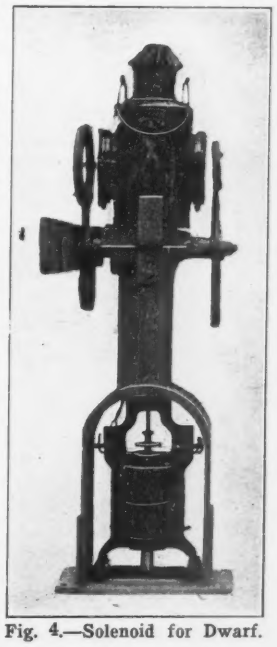


Fig. 4.—Solenoid for Dwarf.

The circuits are so designed that for every function a separate wire is used. To a switch there is one normal operating wire and a reverse operating wire, a normal indicating wire and a reverse indicating wire. For a signal there is a reverse operating wire and an indicating wire. A common wire—"negative common"—is run to each switch or signal and permanently attached to one pole of its motor or solenoid. This common acts for the indicating as well as for the operating circuit.

The manner of protecting the various functions from the effects of a cross wire is simple. If there is any cross on the indicating wire which would ordinarily give a false indication its presence is detected before the lever is moved, for the magnet would be energized and the indicator roller held in the extreme end of the inclined portion of the indicator slot, thus locking the lever in that position. Unless the indicating circuit to be used is perfectly free from current no movement of the lever can be made. The "safety" springs on the lever are so connected that when the lever is standing in the normal position the reverse operating wire is connected through one of these springs to the negative common. Thus any positive current which may reach the operating wire from any source has a path provided for it through the machine to the negative common, which is a path practically of no re-

sistance; so that no current will flow through the motor or solenoid. Every wire leading from the positive common at the machine is provided with a fuse. The result, therefore, is that any cross between operating wires causes one of these fuses to blow, thus at once locating the wire which is causing the damage.

Freight-House and Local-Freight-Train Work.*

The subject of Mr. Banks' paper was, "Who is responsible for over, short, and bad order freight?" The substance of his recommendations is to have more care taken in billing and in trucking package freight from house into cars, to have enough men on the local freight train (at least three brakemen), and to hold them to a strict account; and to see that the train despatcher does not favor other trains at the expense of the local. To remedy mistakes in billing, shipping tickets should be checked with the impression copies of way bills as soon as the day's billing is finished. The plan of loading cars by giving the truckman a ticket for each truck load is exceedingly inexpensive compared with the prevention of errors thereby effected. Speaking of the misconduct of train despatchers, Mr. Banks says: "He lays out the local for everything else, and when he gets it going he is in such a hurry to get it somewhere else that he doesn't want the crew to spend any time in such frivolous things as waiting for an agent to check the freight unloaded, or in waiting to look for a box that is not in plain sight from the middle of the car. The train crew is expected to throw the freight out on the platform and let the agent check it after the train has gone. If the agent calls for a package that happens to be buried the conductor says 'that's short' and gives the engineer a signal to go; he doesn't want to give the agent time to seal the car."

Bad-order reports seem to increase each year and each month. Efforts to load cars to their capacity cause damage, heavy freight being loaded on top of frail articles. Freight for too many districts is loaded into the same car Freight is stowed so that it shifts position when a powerful engine takes the slack out of a long train. It is impossible to stow packages so that these big engines will not knock them around. Rough switching causes much damage. By careful attention to local freight train work. Mr. Banks has succeeded in reducing loss and damage claims 75 per cent. within three years, though business all the time was increasing.

Answering a question, Mr. Banks estimated that automatic couplers and big engines have increased damage claims 40 per cent. Describing the prevention of errors in loading, Mr. Banks said: "There are two systems I am familiar with, one of which is known as the ballot system. The agent takes some little tickets and stamps on these a number. We will say he is loading ten cars and he arranges ten sets of numbers. On a hook in one of the cars he puts all of these tickets Number One, in another car those Number Two, and so on. The check clerk in sending a trucker to a car requires that he shall bring back from that car one of these tickets, which is an assurance that he has got the freight into the right car. That necessitates the check clerk calling his truckers back to him. They must return to the check clerk after depositing the freight. The other system works in the opposite direction. The check clerk gives the trucker a ticket and after he goes to the car he deposits it in a little box. If the ticket bears the number five, he must deposit it in box number five. By and by a young man comes along and takes the tickets out of the box." If the ticket number and the box number do not agree, the freight has been put into the wrong car. It does not pay to have these tickets consecutively numbered, as the number of errors is too small to warrant the expenditure. Loading tickets are used in Chicago by the Rock Island, the North Western, the Alton, and the Burlington.

In certain Chicago freight houses the "no gang" system is used in trucking. No trucker works for any particular check clerk. They work back and forth and seesaw around. The trucker starts out from the north end of the house, we will say, with a load to go to the extreme south car. He goes into the car and drops his truck and comes out and picks up an empty truck and goes to the nearest check clerk he can find and drops the truck there, and picks up a loaded truck and goes off somewhere else. He may not get back where he started from for an hour. In the ballot system he still carries the ticket. In the opposite system he finds a ticket under a little clip on the handle of the truck. The trucker comes along and finds a ticket in there, box 5, door 6, so as to give the location, and he knows which way to go. He goes down and drops the ticket in and drops the truck and picks up an empty truck which the stevedore pushes out. They have more than twice as many trucks as truckers.

Freight agents in Chicago differ in opinion as to the economy of the "no gang" system. One agent tried it and went back to the gang system, because the cost was too high.

A freight house foreman on the Burlington, in St. Louis, looks over the truckers' tickets to see which men are the best. He found some carrying twice as many loads in a month as others. He then posted a performance sheet and caused such an improvement that he was able to dispense with a number of men.

Answering questions about having work done in freight houses by the ton, Mr. Wentworth of the Pennsylvania Lines said that the tonnage basis was satisfactory in the freight houses of that company in Chicago. At the time of the labor troubles in that city but very few of the employees of the Pennsylvania struck. The men of a gang work together harmoniously and many have continued in the same places for years.

Taking up again the subject of checks for each truck load, a letter was read from an officer of the New York Central saying that at two large stations in New York City the loading errors were reduced to 3 per cent. of the former number, and the cost of loading was at the same time reduced from 52 cents a ton to 43 cents.

*Abstract of paper read before the Iowa Railroad Club, March 15, by Charles T. Banks, Freight Claim Agent of the Chicago Great Western, and of the discussion thereon.

Flexure of Reinforced Concrete Beams.*

BY W. KENDRICK HATT.†

The writer has been conducting experiments to determine the proper method of analysis of the strength of a combination of steel and concrete under flexure. These experiments, in which the writer has been assisted by students in the School of Civil Engineering, are still under way and will be described in detail when more complete. He has been concerned chiefly with experiments which would serve to test the validity of this analysis. For

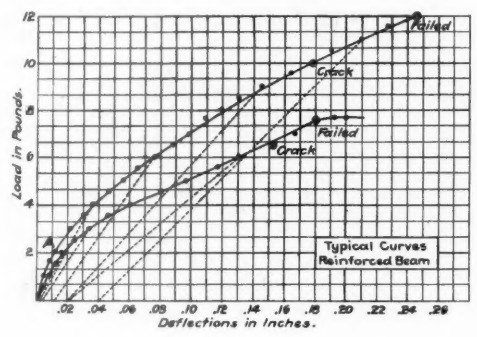


Fig. 1.

this purpose it was necessary to use uniform materials of a high quality. The experiments were therefore conducted on beams made of rich concrete and reinforced with plain bars without any bond other than natural adhesion between the cement and the steel. In the construction of the beams the proportion of the steel was so modified and so placed in various portions of the cross-section as to create a variety of conditions in order that the flexibility of the theory might thus be tested. The concrete represented good arch-ring concrete. No attempt was made to develop those weaknesses which at times result in particular kinds of failure in certain forms of practical construction. Accompanying the tests on beams have been tests on steel and on concrete both in tension and compression.

It is no part of the present purpose to reproduce the algebraic work back of the equations which are the result of his analysis. The original paper containing this analysis may be found in the Transactions of the American Society for Testing Materials, Vol. 11, page 161, and in the *Railroad Gazette*, Oct. 10, 1902. Figs. 1 and 2 of the present paper are reproduced from the original paper. The theory takes account of that part of the bending mo-

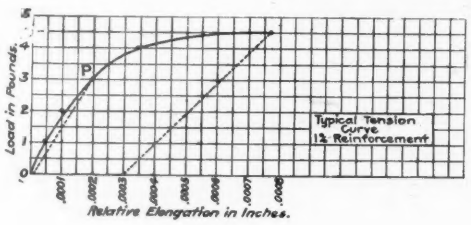


Fig. 2.

ment due to tensional forces in the concrete; and it supposes a parabolic law of variation of the stress in the concrete of the beam with the distance from the neutral axis.

The tests were on beams 8 in. x 8 in. in cross-section made of 1-2-4 concrete. The stone was limestone, crusher-run below 1 in. The proportions were by loose volume. The beams were tested under a center load on an 80-in. span. The tests have disclosed the following facts:

1. The flexibility of reinforced concrete beams, that is, the degree of deflection before cracks, visible to the naked eye, are formed in the lower part of the beam, is about 10 times that of a beam without reinforcement. This observation checks Considere's results, who found that reinforced concrete would, without cracking, submit to an extension at least ten times that ordinarily experienced by plain concrete. The benefit of this increased flexibility is that thereby the strength of the concrete in compression may be largely utilized. The strength of a beam reinforced with steel rods whose cross-section constitutes 2 per cent. of the cross-section of the beam was from four to five times that of a plain concrete beam. In fact, beams may be designed in which factors of safety in all the three elements—that is, steel in tension, concrete in compression and in tension—may be very nearly equal.

2. In the presence of this 1-2-4 concrete the first visible failure was a tension crack in the concrete at the center of the beam. The failure was not due to a slipping of these plain bars in the surrounding concrete nor to the effects of the shear. Beams tested on a 40-in. span yielded similar tension cracks. In certain further tests, however, made on leaner concretes (1-3-6), failure has been due to a pulling out of the bar from the concrete near the end of the beam. Accompanying this pulling out was a crack in the beam running up from the support towards the load. This latter crack is sometimes called a shear crack, but is really due to tensional stresses which are the resultant of internal shears and longitudinal stress. The value of some mechanical bond or of some form of stirrup or abutment in such cases will be evident. The only failure purely of the nature of a shear is the separation which sometimes occurs in a horizontal plane just above the reinforcement. This latter separation has only occurred in the writer's experience in a beam which was so highly over-reinforced that there was very little concrete between the steel bars.

It may be noted that these tests were under conditions of concentrated loading, and that failure near the end of a beam, due to shear, would be more likely under uniform loading; since for the same center moment the shear is double under a condition of uniform load as compared to concentrated loading. The value of the vertical shear per square inch of cross-section of the beam tested by the writer was on the maximum about 160 lbs. per sq. in. The resultant of two shears at right angles to each other is a tension of the same amount, and this might easily rupture ordinary concrete. The tensile strength of the concrete in the 1-2-4 beams was nearly 300 lbs. per sq. in.

After the first visible crack is formed in tension it spreads upwards. Then the strength of the steel in tension and the concrete in compression is brought into play. The higher the elastic limit of the steel the more one postpones the point of rapid increase of the width of this crack, and when steel is used of sufficiently high elastic limit and in sufficient quantity the compressive strength of the concrete in the upper flange will be developed. In the writer's tests of stone concrete beams reinforced with wrought iron whose elastic limit was 36,000 lbs. per sq. in., a 2 per cent. reinforcement failed to develop the compressive strength of the concrete. In no tests with 1-2-4 concrete beams has the first visible failure been other than a crack in tension at the center of the beam. The

REINFORCED CONCRETE.

Diagram showing variation of K with P. For different values of M. n = 2 and u = 0.95. —Fig. 3. For point "A."—

(For use in Formula $\frac{M}{bh^2} = Kt$ where

M = The bending moment in inch pounds.
b = Width of beam in inches.
h = Depth of beam in inches.
t = Tensile strength of concrete which is 1/10 the compressive strength, in pounds per square inch.)

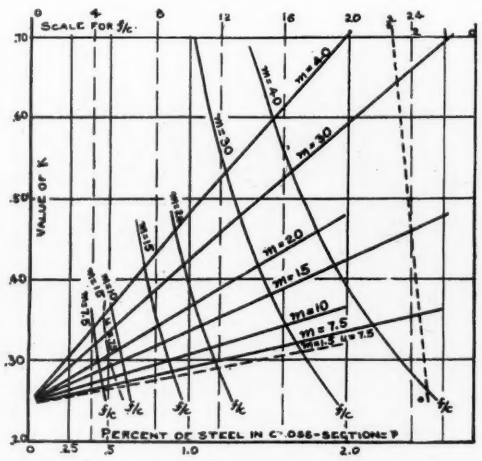


Fig. 3.

above remarks also apply to tests of 1-5 gravel concrete beams of similar size and loading.

3. The behavior of the reinforced concrete beams under flexure was as shown in Fig. 1. It will be noticed that the ratio between load and deflection remains very nearly constant up to point A, which is one-half to one-third the maximum strength. The diagram then becomes of less inclination to the deflection axis and the deflection proceeds until a crack visible to the naked eye appears in the tension side of the beam and a deflection of about one five-hundredth part of the span. In the case of gravel concrete beams the maximum load coincides with the load at first crack.

It is probable that at point A there are minute cracks invisible to the naked eye, and the writer understands that certain observers have lately developed these minute cracks. These are explained by the following considerations: When a piece of plain concrete is pulled in tension the first minute crack which forms is afterwards rapidly developed into a plane of rupture; but when the same concrete bar is reinforced with steel rods the spreading of this minute crack is prevented, with the consequence that the concrete bar cracks in a number of places throughout the entire length, and that the extension at the point of failure is much greater than that extension experienced by a plain bar at the time of failure. Thus, Considere has found, and his tests have been checked by the writer, that plain concrete in tension experiences an extension at the time of rupture of only one-tenth that experienced by reinforced concrete. In other words, the steel acts as hair

*Read before the Western Society of Engineers.
† Professor of Applied Mechanics, Purdue University.

does in plaster. A diagram representing a test of reinforced concrete in tension is shown in Fig. 2.

In the case of a reinforced concrete bar under tension we may suppose that these minute cracks begin to form at point P preceding the rapid increase in elongation in Fig. 2, but no one of these minute cracks spreads to form a visible crack until the further extension of the bar. It does not seem that these minute cracks are of any practical consequence. The crack which is called by the writer "first crack" is a crack visible to the naked eye such as would be an evidence of weakness in an actual structure.

The writer has advanced a theory to account for these three points, A, first crack, and maximum strength, and finds the theory is flexible enough to predict the behavior of a beam at various stages of the test when such beam is reinforced with different percentages of metal placed at different parts of the cross-section. The equations of the theory are complicated and difficult of computation, but they may be represented graphically or may be replaced with a simple formula which may be called the "Straight Line Formula for Reinforced Concrete Beams." While these equations (*Railroad Gazette*, Oct. 10, 1902, page 773) are complicated, that part of the expression for bending moment in brackets (equation 5), which depends on the percentage of the steel and the quality of the concrete approaches so nearly a straight line that for ordinary degrees of reinforcement the latter will serve all purposes. This straight line formula to cover the test so far made is given below and also a diagram which shows the nature of the equations in more elaborate theory.

Straight Line Formula.

$M = Ktbh^2$.

Where M = Resisting moment in inch-pounds.
P = Percentage of steel in cross-section in lower flange (not to exceed 3).
b = breadth of beam in inches.
h = depth of beam in inches.
t = tensile strength of concrete in pounds per sq. in.
u = the fractional depth of the steel from the top of the beam.
K = a constant, which is as follows:

For 1-2-4 stone-concrete beams:

$K = [1/3 + (7/4\ u - 1)\ P]$

Or $M = [1/3 + (7/4\ u - 1)\ P]tbh^2$

For 1-5 gravel concrete when $u = 7/8$

$M = (1/3 + 3/4 P)tbh^2$

The value of t may be taken as one-tenth the crushing strength in the case of stone concrete, and one-ninth the crushing strength in the case of gravel concrete. This fact has been determined by actual tests made by the writer. The values given in Table I have been derived by his tests.

The use of this formula must be followed by a computation of the stresses in concrete in compression and steel in tension, otherwise a per cent. of steel may be taken which would call for too high values of the strength of the concrete in compression. This computation is best performed by the aid of diagrams mentioned below.

The question as to the proper point at which factors of safety should be fixed is of practical consequence. Either the point of appearance of the first visible crack or the ultimate load may be taken. In certain designs, however this ultimate load corresponds to a state of failure which is very far advanced and very much beyond the point of the first visible crack. The writer believes that factors of safety should be fixed with reference to this point of first visible crack.

Fig. 5.—Reinforced Concrete Beams Broken Under Flexure.

Illustration of the Use of the Formula.—Find the strength of a beam 8 in. x 8 in. in cross-section reinforced with 2 per cent. of steel, made of 1-2-4 stone-concrete 28 days old. The center of the steel is 1 in. above the bottom of the beam. Assume t = 280 lbs.

$u = 7/8$.
$M = bh^2\ 280\ (.333 + O\ .55P)$.
If $p = 2$ per cent., $M = bh^2\ 401$.
If a beam is 8 in. x 8 in. in cross-section, M = 205312 in.-lbs.
If the span of the beam is 80 in., the center load = P = 10,260 lbs.

A beam tested under these conditions gave 10,250 lbs. load. The safe load would be about 3,400 lbs.

Use of a Diagram.—Figs. 3 and 4 enable the strength of beams to be computed when made of different kinds of concrete reinforced with different percentages of steel. They enable a simple formula to be used of the following nature:

$M = Ktbh^2$.

Where M = Bending moment in inch pounds.
b = width of beam in inches.
h = depth of beam in inches.
t = tensional strength of the concrete.
K is a constant which depends on per cent. of reinforcement and kind of concrete.

Fig. 3 enables the bending moment to be computed at point A, assuming that n = 2. Fig. 4 enables this bending moment to be computed at the point of first visible crack. The lines on these diagrams are simple expressions of equations in the original paper resulting from

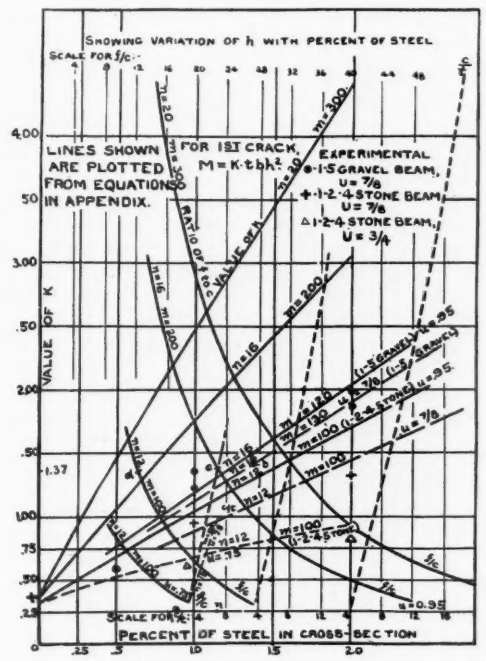


Fig. 4.

the application of the theoretical analysis, and they are not to be used with any practical operations until the experimental points have been located on the diagram to establish the application of these lines to practical conditions.

As has been said, the writer has been working to establish the experimental points on these diagrams. Up to the present time his experiments cover the field represented by the lower lines in the diagram. He has shown so far that the theory is elastic enough to predict the strength of beams made with different percentages of steel placed at different portions of the cross-section, both for point A and for the point of first visible crack. The results of the experiments are compared to the theory in Fig. 4, by reference to plotted points whose values are got from Table II. He expects to conduct experiments to cover the upper lines in the diagram; that is to say, to conduct experiments with lean concrete. The comparison of theoretical and experimental results at point A is not satisfactory.

These diagrams suppose failure to be by bending and not by the effects of shear. The same problem comes up in the design of wooden beams. Before designing a wooden beam one must be sure that equations should be applied for bending and not equations for horizontal shear. With these preliminary remarks the nature of the diagrams are explained as follows:

With the use of the diagram, required the solution of the following problem:

What depth of beam is necessary to carry 10,000 lbs. center load on a 10-ft. span?

Conditions.—1-2-4 concrete one month old. Compressive strength 2,400 lbs. per sq. in. Tensile strength 240 lbs. per sq. in. Reinforcement 1½ per cent. Assume depth of reinforcement from top of the beam equal 0.95 h.

Referring to Fig. 4, run up from the percentages of 1.5 from the horizontal axis to point b on the line marked n = 12, m = 100, thence horizontally to the axis of K to a value of 1.37.

Then $\frac{M}{bh^2} = 240 \times 1.37$. And the required $M = \frac{10{,}000 \times 120}{4} = 300{,}000$

$\frac{300{,}000}{bh^2} = 240 \times 1.37$

If $b = \frac{h}{2}$ $h = 12.20$

The required beam will then be 6 in. x 12.2 in. and will require three $^{11}/_{16}$-in. round bars.

To determine what stresses exist in the steel and in the concrete, consult Fig. 4. From point b go horizontally to the left to point c on the line expressing the ratio of $\frac{u}{t}$ and thence down to a value of 7.2.

Since t = 240, therefore $c = 7.2 \times 240 = 1{,}728$ lbs. per sq. in., stress of the concrete in compression.

From the same point b move horizontally to the left to point d on the line which expresses the ratio of $\frac{f}{c}$, then vertically upward to the scale for $\frac{f}{c}$ to a value marked 13.

Since c = 1,728, therefore $f = 1{,}728 \times 13 = 22{,}464$ lbs. per sq. in. tensile stress on the steel.

The letters n and m on these diagrams refer to constants in the equations in the original paper.

The present evidence from the writer's experiments points to the fact that constants n = 12 and m = 100, are suitable for 1-2-4 concrete; and n = 16, m = 130 for 1-5 gravel concrete.

On Fig. 4 have been represented the results of experiments made by the writer. That is to say, the value of K has been computed from the results of experiments using the value of t as ascertained by parallel experiments conducted on concrete of which the beams were made. It will be observed that the tests on 1-2-4 concrete beams shown by the small crosses and triangles fit the constant n = 12, m = 100 and t = 300 lbs. per sq. in. with a satisfactory agreement. It can be noticed that the theory responds to a change of the value of u from 7/8 to 3/4 when tested by the results of these experiments. The lines shown in Fig. 4 also run out to an experimental point corresponding to a plain beam without any reinforcement.

TABLE I.

Kind of concrete. Cement.	Sand.	Broken stone.	Gravel.	Age, days.	Compression modulus.	Tension modulus.	Ult. strength. Comp.	Tension.
1	2	5	..	90	4,610,000	5,460,000	2413	359
1	2	5	..	28	3,350,000	3,800,000	2290	237
1	..	..	5	90	4,800,000	4,510,000	2804	290
1	..	..	5	28	4,130,000	4,320,000	2405	253

Table I gives the modulus of elasticity and strength of both broken stone and gravel concrete at 28 days and 90 days. The limestone was the product of the crusher below 1 in. The gravel concrete was excellent pit gravel, including sand and pebbles. The concrete was medium wet. The values quoted are based upon tests of 37 compression specimens, involving 202 determinations of the modulus in compression and on tests of 27 tension specimens, involving 79 determinations of the tension modulus. From these results it appears that the ratio of the modulus of elasticity of concrete in compression to that in tension is nearly unity. The ratio of the modulus of elasticity of the steel in tension to the concrete in compression is as follows:

Stone concrete, 28 days	8.8
Stone concrete, 90 days	6.6
Average	7.7
Gravel concrete, 28 days	8.0
Gravel concrete, 90 days	6.2
Average	7.1

TABLE II.—COMPARISON OF THEORY AND EXPERIMENT.

Concrete beams 8 in. x 8 in.; center load on 80-in. span.

Theoretical value of K computed from equations in original paper, using values for first crack:
For 1-2-4 stone n = 12; m = 100.
For 1-5 gravel n = 16; m = 130.

u.	Per cent. of steel.	Age, days.	Tensile strength.	Load in lbs. Point A.	Load in lbs. 1st crack.	Value of K. Experiment. A.	Experiment. Crack.	Theory. A.	Theory. Crack.
				1-2-4 Stone Concrete.					
7/8	0	28	300	1450	2550	0.189	0.335	...	0.332
7/8	1	28	300	2750	7050	0.357	0.920	...	0.920
7/8	2	28	300	3250	10250	0.425	1.340	...	1.420
3/4	1	28	300	2500	5000	0.326	0.685	...	0.670
3/4	2	28	...	2500	6100	0.326	0.825	...	0.950
				Gravel 1-5.					
7/8	½	90	290	2500	4375	0.336	0.589	...	0.72
7/8	1	90	290	3000	8500	0.404	1.34	...	1.12
7/8	2	90	290	3250	13750	0.437	1.85	...	1.90
7/8	1	28	253	2750	7750	0.425	1.20	...	1.12
7/8	2	28	...	3000	12550	0.464	1.94	...	1.90

NOTE.—The value of n and m used above may be arrived at as follows: 1-2-4 *Stone Concrete*—t = 300 lbs. per sq. in. at point at first crack; elongation is one part in 1000; Es = 30,000,000; Ec = 3,600,000. Then $m = \frac{30{,}000{,}000}{300 \div \frac{1}{1000}} = 100$

$n = \frac{3{,}600{,}000}{300 \div \frac{1}{1000}} = 12$

1-5 *Gravel*—t = 250. The gravel beams had the same deflection at point of first crack as the stone concrete beams.

$m = \frac{30{,}000{,}000}{250 \div \frac{1}{1000}} = 120$

$n = \frac{4{,}130{,}000}{250 \div \frac{1}{1000}} = 16$

m = 130 was used in Table II to bring closer agreement.

There was a very decided increase in the freight traffic of the Russian railroads in 1903. The statistics recently issued show that in 1903 the railroads delivered at seaports or border stations 607,160 carloads of grain, which is 6 per cent. more than in 1902 and 34 per cent. more than in 1901. The quantity of coal was 10 per cent. more than in either of the two previous years (yet less than 13,000,000 tons), and the petroleum shipments increased 10 per cent. The grain carried amounted to more than 275,000,000 bushels.

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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The decision of the Supreme Court in the case of the Interstate Commerce Commission versus Baer, commonly known as the Anthracite Coal Case, ruled that the defendants could be compelled to furnish their books and contracts as evidence. Besides the main decision, two other important points were settled, with regard, first of all, to the jurisdiction of the court, and second, to the question as to whether the proceedings had been properly begun by the commission, in view of the fact that they depended on information submitted by W. R. Hearst, who was not a party of interest. The court affirmed its own jurisdiction, and said further that under the mandatory provision of the law it was irrelevant that Mr. Hearst had sustained no damage, and that the commission could not do otherwise than prosecute. Wide comment has been made on the precedent which this decision seemingly gives the commission in demanding information, although the ruling does not materially affect the outcome in this specific case, as the books and contracts desired were in the hands of the commission prior to the decision. Whether that body has really gained any new powers may be doubted, and it is probable that when the coal companies in the first instance refused to produce their contracts they stood less on a belief that the demand was illegal than on a desire to tide over the then existing period of rather acute hostility and give public sentiment a chance to become rational again. Viewed entirely as a question of public policy, there are certainly two sides to the enforcement of corporate publicity beyond very moderate limits. The much censured statement which was made during the coal strike controversy, that the public was not competent to understand the details of operation of a great corporation, is often painfully true. Shareholders in corporate enterprises and those legitimately desiring to become shareholders may have use and need for much detail information, though it frequently happens that they misinterpret what they receive, but they are not the "public," in the correct sense of the word; they are proprietors, actual or prospective. In spite of the virtues of straightforwardness, it occasionally seems as if the trend of recent decisions would be to drive extreme publicity to the point where some sort of reaction might be expected and desired. Even in the glare of the lime light, no shadow is cast by a gentlemen's agreement, and it is worth considering just what right the outside "public" has, when all is said, to require that such corporate affairs as are not yet edited for publication must be confined to this shadowless kind of existence, which publicity legislation cannot see.

Electricity for Heavy Freight Service.

The paper by Mr. Francis on the Lackawanna & Wyoming Valley road, printed in another column, is quite complete from the standpoint of civil engineering. But it makes little mention of the traffic features, especially of the importance of the experiment in hauling heavy freight by electricity, in competition with steam railroads. It has been pretty well demonstrated during the past five years that electric power is not only an economical prime mover for short haul passenger traffic, but an exceedingly profitable one, because the frequent service, in which the traffic is handled in small units, creates business all out of proportion to that which previously existed. But heavy freight traffic has been regarded by disfavor even by those managers of interurban roads who have been most successful with their light freight and package service, on the ground that the serious business of such a road is the transportation of passengers, and that the additional tracks necessary to enable freight trains to keep out of the way of passenger trains are not feasible or desirable on an interurban road. With the electrification of a steam railroad, however, the freight problem presents an entirely different aspect, and those who believe that electricity is destined to take an important part in heavy transportation in the near future, are especially interested in its accomplished and prospective economies. The saving in coal consumption which should be effected by electrifying existing steam railroads has been frequently discussed, as in the able paper by Mr. A. H. Armstrong, printed in the *Railroad Gazette* Jan. 15. A recent writer extends the argument to show that it will be possible to haul by electricity freight trains much heavier than is feasible with steam locomotives, though he does not make it quite clear that he has considered drawbar limitations. It is by no means certain, however, that heavy trains are essential for economical operation when electric locomotives are used. As has been suggested, heavy trains could be hauled by interpolating power units at intervals throughout the length of the train; all being controlled from the cab of the first locomotive. But this arrangement makes necessary the use of wiring beneath each car, which would not be feasible unless electrification were general throughout the railroads of the country.

It would seem that a very important economy in handling freight should become possible through the application of the same principle which now makes interurban passenger working economical—the principle of the better adjustment of the motive power to the needs of the traffic. Interurban passenger roads have not been made to pay by hauling standard passenger trains with electric locomotives. They have made their profit by handling the traffic in small units. With electricity a small train can be hauled with approximately the same proportionate dead weight as a long train, and where now freight cars are held in the classification yard until a long train has been made up of cars bound for the same point, it would perhaps be possible to haul a few cars at a time direct to their destination. It is, of course, evident that if this were done, the mileage of the rolling stock could be greatly increased; perhaps doubled, perhaps tripled, so that a much smaller number of cars could handle the traffic on a given road. Under ordinary conditions, the preferable way would be to haul out the cars in trains of five or ten, rather than in trains of 40 or 50, creating a service similar in its general principles to that of the interurban passenger cars. At least a considerable proportion of the better relation now found in the passenger service between actual business and the cost of it, could be made to hold true in freight service as well. Moreover, on an electrified road, freight trains could be run through to their destination without the stops now necessary for water or to change engines—which is very important in handling perishable freight or live stock—and this, together with the ability to run a 10-car train practically as cheaply in proportion as a 50-car train, would greatly accelerate freight traffic.

No one can prophecy just how much business would be found if it were possible to reduce by half the time required for freight deliveries, but it is reasonable to expect that the increase would be great. Probably no one had fully realized the importance of convenience as an asset in passenger traffic until the electric roads demonstrated it, within the last four or five years. As against the saving in rolling stock, however, and the considerable increase possible in freight car mileage, it must be considered that the number of locomotives required for the service must also increase. It is certain that the simplicity of the electric units will lessen the cost of maintenance and decrease the liability of failure in service. The absence of reciprocating parts on the locomotive will also have a favorable effect on the cost of repairs to track, bridges and permanent way. Furthermore a steam locomotive including a tender has not more than 50 per cent. of its weight available for tractive adhesion.

It has been estimated that, as far as the cost of power is concerned, there would not be much difference in the cost of hauling 50 cars in one train behind a steam locomotive, and hauling five 10-car trains behind electric locomotives. It may be said that to equip with electricity an existing steam railroad would cost, by rough computation, three times the value of the present locomotives on the road, since the power exists in triplicate; once in the power house, once in the sub-station, and once in the locomotive. The saving through the increased service from the freight cars is still an entirely unknown proportion. The increased business which could be secured, and the saving through avoidance of congestion at terminals, is also an unknown quantity, and a very important one. Experts in heavy electric traction believe that the actual saving, apart from increased business, would be fully enough to provide the interest on the original investment required by the change, but this estimate, unfortunately, is still theoretic. If the Lackawanna & Wyoming Valley, built chiefly for experimental purposes, and, therefore, unusually free to investigate, can solve some of these unknown qualities, it can perform a highly important service to transportation in general. The operating arrangements at present provide for the haulage of most of the freight by steam locomotives, and the equipment only includes one electric locomotive; but it is to be hoped that with this small start the principles of economical freight handling by electricity can be so developed within a short space of time that the possible benefits from frequent service in small units can be as definitely and as widely known as they now are with regard to short haul passenger traffic.

The Evolution of the Railroad Bond.

The investor who, in the later sixties and early seventies, during the period which immediately succeeded the Civil War, looked to the market for the purchase of railroad bonds found those securities, as a rule, represented by a simple and uniform type. Here and there could be discovered an "income" on a second mortgage bond or a like junior security. But the rule was the first mortgage; and in the eye of the average investor that mortgage was analogous to a realty first mortgage, if for no other reason, because the stock was apt, in those days, to be paid in on the mortgaged road and thus an equity of redemption—as in the common case of mortgaged realty—nominally at least, was created. For, during the fever of railroad construction following the war which led to the financial panic of 1873, railroads, though built very unwisely, were, with a few noteworthy exceptions built honestly and even the proceeds of municipal subscriptions went into the enterprise. The common high rate first mortgage railroad bond of the period was nominally well secured and came into frequent trouble later simply because the project upon which it was based was fundamentally rash, did not find the expected traffic, and in the metaphor of the time, often resolved itself into "two streaks of iron rust and a right of way."

With the panic of 1873 followed by the "long drag" and bitter financial stress through about five years following, the railroad bond enters a new and more varied phase. Old stock and junior bonds—often senior bonds, too—disappear as the first company is snuffed out by foreclosure and reorganization; and the attempt usually successful to rehabilitate staggering railroad properties and at the same time "recognize" interests, launches a new set of junior mortgage securities. Now begins to appear more familiarly the "equipment," the second and third mortgages, and even the "debenture," a term mainly borrowed from England, and not so much a bond as a railroad note of hand. It is a period of reconstruction rather than construction, with the "purchase money" bond, or its equivalent under another name in the foreground. There is in terms of time, no sharp line of demarcation for the period, but it draws to its close in the late eighties. One of its most characteristic traits is the fall of the interest return on the high first mortgage railroad investment. The old sevens and sixes, if well secured, and with a decade or more to run, command a high premium; and, if refunded, carry but five or even four per cent. The Railroad Bond has entered the second period of its evolution, and where the panic of 1873 found that security in only two or three distinct types, the investor of ten years later finds it in half a dozen.

Finally the Railroad Bond reaches its third stage of evolution, coming down to to-day, and a period much more interesting as well as prolific, covering roughly some fifteen years. The junior bonds of the second period were differentiated into new forms.

Railroad properties have waxed, consolidations and "holding" companies come in and "high finance" greets us. As a result we find "general" mortgages of two or three grades: "blanket" mortgages laid on other blankets; "A," "B" and "C" series of outlying securities; the free silver issue of 1896 emphasizing the gold bond; the "consolidation" bond extremely common and its best secured type made a savings bank investment in some conservative States. One great railroad company alone shows us twelve series of debentures. There are "income" bonds, accumulating and non-accumulating, "prior liens" in which the adjective may be either absolute or relative, and a mighty host of the "collateral trust" species of all degrees of security. The grandfatherly old first mortgage of the past-war period, is himself almost extinct, but his grandchildren are many, have of forms and names not a few and still wax and multiply.

In theory the financial critic would say that a process of evolution which has so tremendously expanded the kinds, the grades and the total volume of railroad bonds and, in a sense, forced the bond of to-day into the category of the railroad stock of a third of a century ago, would also imply that the average railroad bond is much more speculative now than then. But the reverse is probably true. In the first place, while the volume of bonds has been vastly augmented, so has the producing power in net earnings of the railroads—the security. Again, and more important, is the fact that, along with the evolution of the railroad bond, has come an evolution of the judgment of "the street" as well as of the individual investor. Both have been educated by experience and both apply to the railroad bond more accurate and searching tests of value. The bond which can establish and hold in our times a high or even fair quotation in the market has to run a sharp gauntlet, individual and personal, as some of the underwriters have found out. Yet another qualifying force is the fact that the strong railroad corporation, with its best senior bonds carrying a 3½ rate and its juniors not more than 4 per cent. shoulder a doubled bonded debt almost as easily as it carried its original seven and six per cent. mortgages. While, therefore, no hard and fast rule can be laid down and plenty of railroad bonds are of the speculative class, the average bond, as evolved during thirty-five years, has diminished rather than increased its margin of fiscal risk. It follows, also, that as a criterion of the condition of the market and representing investment rather than speculation, the bond leaves the fluctuating stock list far behind. When the street was troubled a few months ago by the long and continuous fall reaching 30 or 40 points in shares of dividend paying roads conservative minds were less disquieted when they saw the underlying strength of senior and junior bonds which fell in most cases only from two to five points each and have since almost or quite recovered.

There remains, to be considered briefly, the large volume of street railway bonds thrown on the market since the enormous expansion of electric lines which began some fifteen years ago. Here history, in part, has already repeated itself. The street railway companies, like the steam railroad companies of the later sixties, have started with first mortgage bonds almost exclusively which have not yet evolved much into junior liens. But, unlike the original steam roads, the bonds have in very many cases had small equity or no equity at all in cash stock. In theory, again, such financing ought to have resulted in just such a calamity as overtook in the Autumn of 1873 the too excessive building of steam roads; but the electric roads have thus far been saved and probably will, as a whole, prosper by the unforeseen popularity of the new motive power. It will be interesting now to see, as the years pass, whether the electric railway bond follows the same process of evolution and sub-division as that of the steam corporations. It will probably do so unless a grander evolution reaches both the electric and steam roads and merge them in one.

An Omaha reporter has discovered a mare's nest. A press despatch from that city, noting the appointment of Mr. B. A. Worthington as assistant to Mr. Kruttschnitt, Director of Maintenance and Operation of the Harriman lines, says that the heavy shippers of that city see in the appointment an effort to force the heavy loading of trains "regardless of the interest of the shipper." Mr. Worthington has been Superintendent of the Coast Division of the Southern Pacific, and "is recognized as an expert on the tonnage system." He is going to devote his attention to questions of through freight and passenger schedules and assignment and distribution of motive power and equipment; and the Omahaugs have discovered that he believes "in loading every engine which travels the line to its fullest capacity, no matter when the goods may arrive at destination. It looks to us as if the western roads are devoting their entire time to perfecting a system which is in direct opposition to the interests of the shipper." What is here meant by the "interests of the shipper" can only be conjectured, as the interview was cut off at this important juncture. The western roads are, indeed, devoting their time to the problem of moving freight with the utmost economy; and they have hitherto been innocent enough to suppose that this course would benefit the shipper, by making possible a reduction in rates. Evidently they are pursuing the wrong course. To please an Omaha shipper the true policy is to constantly keep a fast locomotive (with steam up) at each freight station, packinghouse and country stock yard, and whenever the shipper finishes loading a car, start with it for Chicago. To make good time, the engine ought to have only this one car; but probably it would be well to provide a caboose for each train, with sleeping accommodations for the shipper and his assistant "bull-puncher," as the enjoyment to be got out of a free ride to Chicago is so great that a slight deficiency in speed would be overlooked, probably. The ordinary form of stock-shipper's contract does not clearly provide for carrying shippers free with grain and lard, but that is a detail that can be readily arranged. Arrangements should be made for telegraphing to the Mississippi River long enough beforehand to insure freedom from delay by an open drawbridge. Please the shippers at all hazards.

The United States Circuit Court at St. Paul, April 19, unanimously denied the application of E. H. Harriman, W. S. Pierce and the Oregon Short Line for leave to intervene in the case of the United States against the Northern Securities Company. Judge Thayer delivered the opinion. The Court gave these reasons:

1. The plan of the directors of the Northern Securities Company for the distribution of the stock of the Great Northern and Northern Pacific companies is not violative of the decree in the Northern Securities case.

2. No one but the United States can successfully appeal to the court to enjoin the execution of that plan on the ground that it is in violation of the Sherman Anti-Trust Act, and the United States expresses satisfaction with the present decree.

3. The stock of the two railroad companies is not in the custody of the court.

4. An intervention is not necessary to enable the petitioners to protect any pecuniary interest or equity they have.

Comment was made in the *Railroad Gazette* at the time the suit was begun that in the event of ultimate appeal to the Supreme Court that body would apparently find itself under the necessity, whichever way it turned, of fortifying a combination in restraint of trade, since a decision for Harriman would leave control of the Northern Pacific with the Union Pacific interests, and a decision against Harriman would leave it with the Great Northern. The opinion of the Circuit Court on this point was expressed as follows:

"The issues suggested are disputed and debatable questions of fact which the parties would be entitled to litigate with witnesses and evidence after leave to intervene had been granted, and we decline to consider them or the affidavits or excerpts which present them upon this motion. According to well established rules, the petitioner cannot intrude into this litigation merely to protect the public interest so long as the Government is present by its Attorney-General and expresses its disapproval of such intrusion."

The Kansas coal train of 15 or 20 cars which took a wild run of a hundred miles without an engine one moonlight night a few years ago, when a west wind, an easy eastward grade and a road clear of trains furnished the right combination of conditions, has passed into history; so far in, that most of us had forgotten it. But—like the case of the freight car which becomes derailed and jumps down a bank, and does the job so neatly that the rear portion of the train couples itself to the forward portion and the conductor never knows that he is one car short till the car accountant tells him—the runaway train seems destined to be a permanent though infrequent "feature" of life on the plains—or those parts of the plains which gently slope eastward. It figures in the press despatches of the present month in an item from Hugo, Colo., as follows: "A very high wind came up very suddenly from the northwest about 3 o'clock this afternoon, which for a few minutes was the worst ever known here; one could not see 20 feet for the dust. A box car was blown from the sidetrack on to the main line and ran to Aroya, 30 miles east of here, where it was stopped by the section men. The despatcher was immediately notified and the track was cleared of trains so that no damage was done." As long as the despatcher is able to clear the track, an item like this makes entertaining reading; but when such a runaway meets a passenger train there is another story. A derail at the lower end of every sidetrack that is on a grade is an inexpensive device. Even without being interlocked with the main line switch such a device is well worth having, if the discipline is good enough to insure its regular use. Not long ago one of the Government bulletins reported a collision costing $50,000 (Bulletin No. 5, item *w*) which would have been prevented by such a derail. Half that sum would provide safeguards at all the down-grade sidetracks on almost any railroad. A moderate expenditure yearly would soon bring our equipment up near enough to that of the railroads of England to enable us to compare the two countries in this respect without having to shut our eyes to the facts, for shame. Any station agent who is responsible for the security of cars on sidetracks ought to be glad to use a derail, for the added peace of mind that would be his on windy nights. A reasonable consideration of the interest of such agents is much better than to try to prove that our railroads are safer than those of England.

It seems that the American Railway Association is going to break all precedents by choosing for president a man who is not an operating officer and whose early training was in the financial department. The only nominee mentioned for next Wednesday's election is Mr. Stuyvesant Fish, president of the Illinois Central, and everybody seems to expect that he will be unanimously elected. Though he has never been a superintendent or an engineer, Mr. Fish is what may be called an operating president, for he takes a constant, intelligent and very active interest in the operating and engineering departments of his road. His peculiar fitness for the presidency of the Association is based, however, on his exceptional qualifications for the chairmanship of the American section of the International Railway Congress. This chairmanship will undoubtedly be conferred on the president of the Association, and the meeting of the Congress in Washington next year will make this office of the first importance. Mr. Fish's road being a prominent one in both northern and southern territory, he is in close touch with other members of the Association in widely separated States; and as his road has headquarters in both Chicago and New York, he is neighbor to the officers of practically all of the important railroads of the country. Besides this, he is prominent in business life outside of railroad circles, and in social life; and his many years' connection with the financial offices of the Illinois Central has made him well known in Eroupe. Preparations for the coming Congress will be an important part of the A. R. A. officers' activities during the coming 12 months. Aside from the presidency, it does not appear that important action is expected in any direction at this meeting. Per diem car-service is always a live subject, and the desire to increase the rate to some figure far above 20 cents still prevails; but all of the principal roads seem content to wait another six months, at least, before taking action.

The United States Supreme Court on April 11 decided that it did not have jurisdiction in the case of the State of Minnesota against the Northern Securities Company and the Northern Pacific and Great Northern railroads, involving the validity of the proposed merger of the railroad companies. The main importance of the decision, in view of the fact that it comes after the principal merger decision, lies in the indication that United States courts cannot entertain jurisdiction in similar cases. In summing up, Justice Harlan, who delivered the unanimous decision of the court, said: "For the reasons stated, we are of opinion that the suit does not—to use the words of the act of 1875—really and substantially involve a dispute or controversy within the jurisdiction of the Circuit Court for the purpose of a final decree. That being the case, the Circuit Court, following the mandate of the statute, should not have proceeded therein, but should have remanded the case to the State Court. The decree of the Circuit Court is reversed and the case is sent back with directions that it be remanded to the State Court."

Chicago, St. Paul, Minneapolis & Omaha.

The year ending December 31, 1902, was a prosperous one for the company, although net earnings were somewhat smaller than in 1902, because of the greatly increased cost of conducting transportation. Gross earnings were $12,055,271, an increase of $147,746, pretty evenly divided between passenger, freight and miscellaneous, including express and mail. The total operating expenses were $7,726,662, an increase of $243,409, leaving net earnings of $4,328,609, nearly $100,000 less than in 1902, but considerably greater than in any previous year. The most striking feature about the operating expenses is that a total increase of over $243,000 occurred simultaneously with a decrease of $259,956 in the charge for maintenance of way and structures. The charge under this heading was smaller in 1903 than in any year since 1897, but was probably ample, as the road has been well maintained for a series of years and the present charge is at the rate of over $1,000 a mile for the 1,660 average mileage worked. The discouraging feature about the heavy increased cost of conducting transportation —the increase amounting to over $374,000—is that it is blamed, in considerable part, to the increased wages paid all classes of labor, and that this increase was only fully effective during the last months of the year, so that if wages continue to be paid on the same scale it would appear that this item will affect earnings even more seriously this year. The other sources of increased operating expenses were the higher cost of fuel and the normal cost of moving heavier traffic. Fuel cost $146,524 more than it did in 1902, an increase of over 12 per cent., although ton miles increased only 5¼ per cent. and passenger miles showed a fractional decrease. Engineers and firemen were paid $55,000 more wages than in 1902, and the increase to employees all along the line seems to have been proportional.

There was no change in the total funded debt as compared with 1902, and the capital stock has remained unchanged for well on towards 20 years. In fact, the road

is noteworthy for the way in which the property has been developed out of current income without increase, or with very small relative increase, of the capital obligations Expenditures charged to the improvement fund during the past year aggregated $604,212, entirely apart from the charge for maintenance, and a balance of $81,128 was carried forward for this purpose applicable for use in the present year; $500,000 was added to the fund by the directors, out of net income for 1903. The balance to the credit of the fund, December 31, 1903, was, therefore, $581,128, compared with $685,340 last year. There is also an equipment fund charged to operating expenses, and cars costing $40,948 in the aggregate were charged to this fund during the year, leaving a credit balance, December 31, of $84,907; $99,969 was added to the fund and charged to operating expenses during 1903.

The following table gives the principal statistics of operation:

	1903.	1902.
Average mileage worked	1,660	1,605
Passenger earnings	$3,178,053	$3,137,708
Freight earnings	8,224,296	8,159,226
Gross earnings	12,055,271	11,907,525
Maintenance way and structures	1,677,326	1,937,312
Maintenance of equipment	1,147,250	1,055,517
Conducting transportation	4,206,134	3,832,007
Total operating expenses and taxes	7,726,662	7,483,254
Net earnings	4,328,609	4,424,272
Betterment appropriation	500,000	600,000
Dividends	1,901,291	1,901,276
Surplus from year's operation	350,435	417,060

Grand Rapids & Indiana.

Increased taxation and heavy expenses for equipment renewals are the chief causes of the poor showing of the Grand Rapids & Indiana in its report for the year ending December 31, 1903. The item of taxes alone added a sum of $235,161 to operating expenses, which was an increase of about 33⅓ per cent. over the previous year. Under the new method of assessing taxes in Michigan, the State Board of Assessors has fixed the valuation of the property at $16.91 per $1,000, as against a former valuation of $16.55. This makes the taxation nearly 6 per cent. of the gross earnings of the road as compared with an average taxation of 2.6 per cent. in the State of Pennsylvania and of 3.03 per cent. in Indiana. Total operating expenses for the year were $3,421,592, as compared with $3,057,419 in 1902. Against this, gross earnings increased only $224,110, leaving a decrease in net of $140,063. These figures are for all the lines directly operated by the Grand Rapids & Indiana, including the Cincinnati, Richmond & Fort Wayne; Muskegon, Grand Rapids & Indiana, and the Traverse City railroads, a total of 589 miles. The transportation of mine products on all lines show heavy gains, but these gains are offset by losses in the transportation of manufactured goods. Passenger earnings increased $133,050 and the total number of passengers carried was 2,111,638, or an increase of about 6 per cent.

Beside the heavy taxation, operating expenses were made greater by a large number of renewals, $537,152 being spent for repairs of freight cars and engines alone. Maintenance of way expenses decreased $13,329, but this was more than offset by an increase of $199,013 in conducting transportation, owing to the higher cost of locomotive fuel and increases in wages. The increase in conducting transportation was especially heavy on some of the subsidiary lines.

At the close of 1902 the unexpended balance of appropriations from income for additions and improvements was $94,051, which, together with the amount appropriated from the income of 1903, made $177,501. Of this amount, $99,991 was spent for betterments during 1903, leaving a balance of $77,510 available for improvements in 1904.

The leading operating statistics follow:

	1903.	1902.
Average miles worked	589	589
Gross earnings	$4,238,885	$4,014,776
Operating expenses	3,421,592	3,057,419
Maintenance of way	657,333	670,662
Maintenance of equipment	644,427	569,748
Conducting transportation	1,780,609	1,581,595
Taxes	235,161	137,500
Net earnings	817,294	957,356
Rentals	120,335	174,976
Net income	698,833	784,469

NEW PUBLICATIONS.

Reports of the Mosely Educational Commission. London: Published for the Proprietor by the Co-operative Printing Society, Limited. Tudor street, New Bridge street, E. C. 1904.

It will be recalled that Mr. Alfred Mosely's educational commission is the second body of expert observers which this public-spirited English citizen has brought to the United States to see and report on American conditions. His industrial commission, composed of representatives from nearly all the leading British trades, made its report a year or so ago, and a review of its work was printed in these columns. The educational commission was designed in part to find out how it was that we turned out such good engineers in the United States. To quote from Mr. Mosely's preface: "The story of the origin of the industrial and educational commissions to the United States takes me back to South Africa some 15 years ago. I had for many years been engaged in mining operations at Kimberley, which, in common with the great bulk of the work of the diamond diggers, had proved unremunerative, when Gardner Williams, the Californian engineer, arrived in South Africa and took over the management of the De Beers Company, which the late Mr. Cecil Rhodes was just then amalgamating. Gardner Williams, in turn, imported the late Louis Seymour, and these two were followed by many other American engineers, including Perkins, Jennings and Hammond. Under the guidance of these able men, and many others, the development of South Africa was started, and, in my opinion, her mining centers largely owe their primary success and subsequent prosperity to their efforts. . . . The success of these engineers turned my attention to the United States and some years ago I paid my first visit there for the purpose of seeing what sort of country it was that was responsible for sending so many level-headed men to the Cape."

On this most recent trip Mr. Mosely was accompanied by 26 English educators, who were his guests and whom he asked to report on (1) the development of individuality in the primary schools; (2) the social and intellectual effects of the wide distribution of secondary education; (3) the effect of specific instruction given in business methods and in applied science, and (4) the present state of opinion as to the value of professional and technical instruction of university rank designed with special reference to the tasks of business life.

The report is a pamphlet of 400 pages, in which each of the gentlemen forming the commission published the results of his own investigations, the work having been so planned that a wide field was covered. It is an interesting document of criticism and appreciation of American educational and, incidentally, American social organization, as viewed through British eyes.

A Clean Chimney. By A. Bement. Published for private circulation by Peabody Coal Co.: 1904. Cloth, 48 pages. The formal title of this little book, "The Economical Burning of Coal without Smoke, with Especial Reference to the use of Washed Coal," expresses more fully, perhaps, the scope of the subject matter than does the brief suggestive title which is a part of the striking front cover design. The author has confined himself to a practical more than a theoretical treatment of the subject of smoke consumption. The burning of coal is apparently a simple matter, but a fire can vary in quality, and the variation in the quality can make a great difference in the economical production of power. In the introduction the author hits the nail on the head when he says: "No one burns coal as a final object. The purpose of every industrial enterprise is the production of some commodity involving some exact process and each manufacturer realizes this in his special business. None of them consider coal burning as a matter requiring similar exact methods." The chapter headings are: Heat Efficiency; Incomplete Combustion; Smoke and its Prevention; Washed Coal and its Preparation; Manipulation of Fires and Furnaces. Under these heads the various phases of combustion of coal under boilers are considered in a clear and brief way. The book is equally readable for the consulting engineer in charge of a great power plant, or for the fireman in charge of the boiler. Many practical suggestions are included, which, if observed, will do much to abate the smoke nuisance from any boiler, be it equipped with automatic stokers, and all other modern appliances, or be it a saw mill boiler as ancient as the hills. The chapter devoted to washed coal is of much importance, because, in the use of such fuel in the majority of miscellaneous furnaces, will be found the greatest aid to both efficiency and smokeless combustion.

Railroad Commissioners of Massachusetts: 35th Annual Report: 20 Beacon street, Boston. Charles E. Mann, Clerk of the Commission.

This report was noticed, from advance sheets, in our issue of January 22. The bound volume has just appeared. The index to this report fills 24 pages, and contains apparently twice as many references as has been common in former indexes, which were good ones. As in other recent years, separate maps are given of railroads and of electric railways, both corrected to the beginning of the present year. The map of electric lines (2,141 miles of line in the state) now makes a formidable showing. The thickly settled region within 15 miles of Boston is almost a solid mass of red lines, and the interurban roads now extend in a continuous line from the capital south to Fall River (and Newport, R. I.), west to some distance beyond Westfield (in the southern part of the State), and to Orange in the northern part. The Connecticut valley is traversed from the Connecticut boundary on the south to Greenfield on the north, and in Berkshire County the north and south line runs almost to the state boundary at both ends.

The Williamsburg Bridge. By Edward Hungerford. Published by the Celebration Committee of the Board of Aldermen of the City of New York.

The new Williamsburg Bridge, crossing the East river, connecting the boroughs of Manhattan and Brooklyn, was opened with elaborate ceremonies December 19, 1902; and in this volume of 132 pages is given a complete account of the ceremonies attending the opening, and also a history of the bridge from the time of its inception to its completion. It is illustrated with engravings of prominent persons who have been connected with the city administrations and the engineering departments during the time that the bridge was building, and also by a number of photographs of the bridge during its erection and after its completion. Aside from its interest as a souvenir, the book contains many interesting facts about the building of the bridge and comparative statistical tables showing the differences between this second bridge and the old Brooklyn bridge further down stream.

TRADE CATALOGUES.

The Car Interchange Manual, published by J. D. McAlpine, of Cleveland, Ohio, revised to the present year, has been issued by the McConway & Torley Co., of Pittsburg, as a combined "Pocket-book of useful information for master car builders and car inspectors," and advertisement of the Janney, the Buhoup and the Kelso couplers, the advertisements being, presumably, also "useful information" for railroad men interested in cars. The principal part of the book consists of 130 pages of abstracts of decisions of the arbitration committee of the Master Car Builders' Association, including all those of present interest up to and including No. 667. Among the other things in the book are tables showing the depreciated value of freight cars, synonyms of parts of cars known by different names, a list of words often misspelled, illustrations of limits of tire wear for steel-tired wheels, and rules for giving first aid to the injured.

The Toledo, St. Louis & Western has issued a pamphlet showing gross earnings brought up to the year ending December 31, 1903 (estimated at $3,160,000), and commenting on the physical characteristics of the property the condition of its roadbed, terminals, etc., and an account of the local industries along the route. Since the line was rebuilt in 1891-2, it is estimated that nearly $10,000 a mile has been spent on property and equipment. The road earned approximately $7,000 a mile, gross, in 1903.

The American Rock Stump & Tree Removing Co., 52 Broadway, New York, issues a pamphlet describing its new land clearing machine. The pamphlet contains many pictures of the "lifter" in various stages of rock and stump pulling; also a brief description of the mechanism. The size and apparent weight of the rocks lifted by this machine are somewhat appalling, but the pamphlet shows how the work is done by multiplication of power by pulleys and gear wheels.

Morse Twist Drill & Machine Co., New Bedford, Mass., has issued a complete catalogue of the small tools which it makes. Sizes and prices are given for each of tools shown. Among the new tools catalogued are shell drills, indexed cases for sets of drills, counterbores, with interchangeable blades and guides; adjustable caliper gages, standard reference disks, cotter mills, gear cutters, gear-testing machine, bench center and straightening press.

Veeder Manufacturing Co., Hartford, Conn., sends out a small pamphlet illustrating eight types of counters suitable for almost any kind of registering on automatic machines, printing presses or for any place where an accurate record is wanted of the number of operations performed in a given period. The counters are similar in size and appearance to the cyclometers made by the same company.

Blaisdell Machinery Co., Bradford, Pa., publishes its catalogue in the form of bulletins, each containing illustrations and a description of a particular machine or class of machine. Bulletin No. 11 describes what are known as Class AA and Class AD single air compressors. The Class AD machines are steam driven and the Class AA compressors are belt driven.

The Detroit & Mackinac has issued a pamphlet entitled "Haunts and Homes of Fish and Game." It contains a description of the hunting and fishing grounds which may be reached by taking what is known as the Turtle Route of the Detroit & Mackinaw R. R. along the shores of Lake Huron. The pamphlet is illustrated with several interesting photographs.

Buffalo Forge Co., Buffalo, N. Y., has issued a little catalogue of hand blowers for forges. The company's latest design, No. 100, has the crank motion transmitted to the fan through double spiral gears mounted on ball-bearings.

The Value of Heating Surface.*

The Master Mechanics' Association Committee in 1897 recommended a relation between heating surface and cylinder volume of 200 or 220 to 1. The cylinder volume was inconvenient to calculate and has been very little used. I much prefer the recommendation of Mr. Lawford H. Fry, that the tractive power at 85 per cent. be multiplied by the diameter of drivers.† When this is obtained by the heating surface, Mr. Fry's factor BD is obtained. To compare these two ratios, if R be the ratio of heating surface to cylinder volume in cubic feet and P the boiler pressure, then $BD = \frac{935\ P}{R}$; thus values of R of 200 with 160 to 180 lbs. boiler pressure compare with values of BD of 748 and 840 respectively, which are very considerably higher than these for any engines built in the last few years.

I wish to call attention to one way of looking at the factor BD which does not seem to be generally noticed.

*A paper presented to the April meeting of the Western Railway Club by H. H. Vaughan, Superintendent of Rolling Stock, Canadian Pacific Ry.

†*Railroad Gazette, Sept.* 25, 1903.

namely, that it is proportional to the pounds of water that have to be evaporated per square foot of heating surface per hour, and, in fact, if regarded in this way, it appears to me more easily discussed. A number of the later large passenger engines have had very low values of BD, varying down to 600 or 500, and should accordingly have a large margin of steaming capacity if water is evaporated at the same rate per square foot as on older and smaller engines. I have come to the conclusion that this is not the case, but I wish it to be clearly understood that I refer to the steaming capacity of the engines and not to their economical performance.

Fig. 1 shows the values of BD for certain classes of engines of the Lake Shore & Michigan Southern. The values are simply plotted for the classes shown as abscissæ in their alphabetical order, a short description of these engines being as follows:

GENERAL DIMENSIONS OF LAKE SHORE LOCOMOTIVES.

Class.	Type.	Cylr.	Blr. press.	Dia. of drvrs.	Htg. tubes.	Surface fire-box.	Total.	Grate area.	Weight on drvrs.	Total weight.	Service.
A	2-8-0	20½ x 28	180	56	1957	212	2169	32.5	143,500	162,500	Freight
B	2-8-0	21 x 30	200	62	2452	230	2682	33.5	149,000	168,000	Freight
B2	2-8-0	21 x 30	200	62	2786	187	2973	43.0	154,000	174,000	Freight
E	4-6-0	17 x 24	180	68	1440	139	1579	27.0	90,000	115,000	Passenger
E4	4-6-0	17 x 24	160	56	1146	126	1272	22.0	80,000	105,000	Freight
F	4-6-0	18 x 24	190	68	1665	150	1815	27.0	88,000	118,000	Passenger
G	4-6-0	18 x 26	190	68	1550	179	1729	24.0	110,000	140,000	Passenger
H	4-6-0	19½ x 30	180	62	1957	202	2159	32.5	118,000	158.000	Freight
I	4-6-0	20 x 28	200	80	2660	202	2862	33.5	133,000	171,600	Passenger
J	2-6-2	20½ x 28	200	80	3172	190	3362	48.6	130,000	174,500	Passenger
Q	4-4-0	17 x 24	180	72	1234	155	1389	18.0	65,000	104,000	Passenger
Q4	4-4-0	17 x 24	135	62	1073	142	1215	15.1	48,000	74,000	Freight
R	4-4-0	18 x 24	180	68	1425	154	1579	27.3	71.000	107,000	Passenger

The A is a successful class of narrow fire-box, consolidation engine; has always been a good steamer. The B and B2 are Mr. Marshall's consolidation narrow fire-box and wide fire-box respectively. The E is a highly successful light ten-wheel passenger. It was one of these engines that made the splendid run with Dr. Webb's special some time ago. The E4 have been very satisfactory. The F has also been a highly successful class of engine and ran the Twentieth Century Limited during the first summer it was put on, a good performance for an engine of this size.

The G is a solitary engine and has never given satisfaction in passenger service; it has to be used on local or mixed runs. H is a good class of engine for fast freight and has also been used with good results on heavy passenger runs that are not necessarily fast. I is Mr. Marshall's ten-wheel passenger engine on which he decided the limitation occurred in the grate, and J is his prairie passenger. Q is a class of eight-wheel engine that was used in the 20-hour trains in the World's Fair year, but which are very delicate steamers. Q4 is a good eight-wheel freight engine, the class that is seldom heard from; R is an 18-in. eight-wheel passenger, a fair engine but not remarkably good.

Now, remembering that the ratio BD means that the pounds of water evaporated per square foot of heating surface per hour are equal for equal BD, under equal conditions of revolutions, throttle and cut-off, or in other words when engines are being worked up to their relative capacity, I do not hesitate to say that it does not accurately represent the conditions. While the I engines are good steamers they are not on that basis the equal of the E, and I do not consider them quite equal to the F. The Q are certainly not equal to the E or F, and neither are the R. The H are, I think, rather better than the B when pressed. While the question may appear rather theoretical it became of some importance in connection with the design of new passenger power in which we wished to feel reasonably certain that the steaming qualities should be good. Several of the later Prairie and Pacific engines have necessarily, like the I, a flue of considerably greater length that was common on older power and the question has frequently been raised as to whether the figures for heating surface arrived at by the length of the flue really indicated the steaming capacity, leaving out any reference to their economical effect. It occurred to me that an analysis of the experiments carried on to determine the evaporation from various sections of the flue, might give some indication of the allowance that should be made. I refer to those made by M. Petiet about 1865. A boiler having a grate area of 9 sq. ft., fire-box heating surface 60.28, and 125 tubes 1⅞ in. diameter, 12 ft. 4 in. long, had the tubes divided into four sections each 3.01 ft. long, leaving 3½ in. of tubes attached to the fire-box, forming the fifth section. Test was carried out with coke and with briquettes, the former of which may be neglected. With briquettes coal was burnt up to 113 lbs. per sq. ft. of grate per hour, which is a fairly high rate of combustion. Tests were also made with one-half of the flues stopped off.

On looking over the curves showing the evaporation for various portions of the tubes, they appeared to have a general similarity to a parabola. In that case the evaporation per square foot from a flue of any length would be the same if the square root of the length of the flue were taken in place of the actual length. Fig. 2 shows the results when plotted on that basis with pounds of coal per square foot of grate per hour as abscissæ and water evaporated per square foot of heating surface per hour as ordinates. The top line shows the evaporation from the fire-box, the lower ones from the first, second, third and fourth sections of flues respectively. While on the √l basis the second section does more than the first and third and the fourth less, as the rate of combustion increases the proportional difference becomes less important, in other words, the lines do not radiate. While neither the lines for flues or fire-box appear to run through the origin the heavy line amongst the flues is a vector passing through one-half of the evaporation from the fire-box at 120 lbs. coal per sq. ft. per hour and will be seen to very fairly represent the average result. In this connection I wish to call attention to the remarkable regularity of the results. While there is evidently something peculiar about the last two tests, the flues appearing to do the greater part of the work in one case and the fire-box in the other, the results on the whole are excellent and show

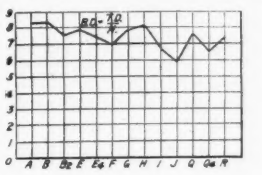


Fig. 1.

Fig. 4.

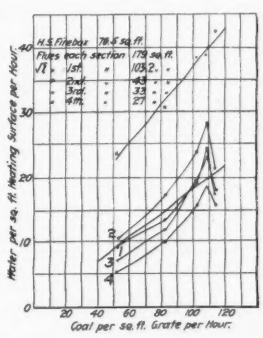


Fig. 2.

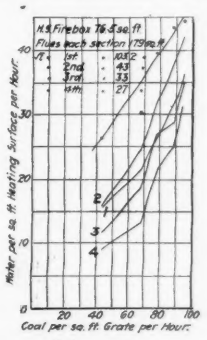


Fig. 5.

accurate and careful work. Also there is no indication of any large departure from straight line results in the vicinity of the points plotted. It would thus appear that if the tube heating surface be measured by the square root of its length and divided by two, a value is obtained for the equivalent heating surface which may be considered as effective for producing purposes as the fire-box heating surface and should be a fairly accurate measure of the boiler capacity. If H be the actual heating surface of the flues, this would be equal to $\frac{H}{2\sqrt{l}}$ when l is the length of the tubes in feet. Another consideration must, however, be taken into account, namely, the amount of heat subtracted by the fire-box. There are many experiments that have shown that if the fire-box is arranged so as not to take away the heat, more work is done by the flues. It is difficult to say, however, how much this is. In Fig. 3 I assume that with the proportions of the experimental boiler the fire-box is unity, and in that case the fire-box does 40 per cent. of the total work and the flues 60 per cent. With no fire-box how much more would the flues do? If their evaporation is measured in the proportion 60 to 80 they will take up half the work that the fire-box did. If 60 to 90, three-quarters, and so on. Whatever the flues do with the fire-box doing nothing, it is probable will be done proportionally with the fire-box varying in size. If this is true the full lines show the total work done, the dotted lines the work done by the flues. It appeared to me that the line 80 would be the best approximation to adopt and in that case we should require a factor that would make the equivalent of the surface $\frac{3}{4}\cdot\frac{H}{\sqrt{l}}$ with no fire-box, as against $\frac{1}{2}\cdot\frac{H}{\sqrt{l}}$ when the fire-box surface is $\frac{2}{3}\cdot\frac{H}{2\sqrt{l}}$ That is, if F is fire-box surface and $A = \frac{H}{\sqrt{l}}$, we wish the equivalent heating surface, which may be called h, to equal as follows:

$$\text{Where } F = \tfrac{1}{3}A,\ h = F + \frac{A}{2}$$

$$\text{Or } h = \frac{2}{3}\frac{H}{\sqrt{l}} + \frac{F}{2}$$

$$\text{When } F = 0,\ h = \frac{3}{4}A$$

which satisfies these requirements. Fig. 4 shows the same classes of engines as previously plotted taking the equivalent heating surface in place of the actual. This certainly equalizes matters greatly and will be found to do so in the case of any of our large modern engines. It will be seen that the E is one of the best of the engines and that the H are better than the A and B, which agrees with our experience. While this method may not be absolutely right, yet I consider that as a measure of effective heating surface this formula has value.

After testing this formula I thought it would be interesting to analyze the experiments with half the flues stopped up and Fig. 5 gives the results for this series as Fig. 2 does for the first series. It will be seen that the square root rule holds exceedingly well even when the evaporation per square foot is 75 per cent. greater than in Fig. 2. There has been an increase in the evaporation of the fire-box which is difficult of explanation, but there is also a considerable increase in that from the flues. The question then arose, "If in place of plotting with reference to the coal burnt per square foot of grate surface per hour it was plotted with reference to the coal per square foot of heating surface per hour, what difference would be shown by the decreased flue surface?" This is shown on Fig. 6, in which the evaporation per square foot of heating surface is plotted with reference to the coal burnt per square foot of heating surface per hour and the results are certainly curious. The "Xs" represent the tests with all flues, the "Os" with half flues, and the same line evidently fits both conditions. This would make it appear as if the amount of flue heating surface made no difference, so Fig. 7 shows the total water evaporated with reference to the amount of coal burnt per hour. The lower line shows the water evaporated from the flues, the upper that from both flues and fire-box. I think that the accuracy of the experiments as indicated by the small variation in the results entitles them to consideration and it would appear that the heating surface has very little effect on the evaporation. In other words, the reduction in the water evaporated was a draft proposition and not one of heating surface, the obstruction due to the decreased flue area reducing the amount of coal burnt per hour, but the decreased heating surface has no effect on the evaporation. It is evident that this statement has its limitations, but it is worth seriously considering whether it is not practically true. Heating surface can evaporate 40 to 60 lbs. of water per hour and may only be taxed to 4 or 5 lbs., so that if it is reduced it simply takes up more heat; and while no doubt its increase leads to economy, within reasonable limits, it would have little effect on the capacity. The thing to do is to burn the coal and get the heat and the heating surface will take it up. If this is true the most important ratio in an engine is that of the steam consumption to the great area, which, if T be the tractive force, D the diameter of drivers and G the grate area, is $\frac{TD}{G}$. This is plotted for the Lake Shore engines on Fig. 8, and while not the only thing to be considered, shows the importance of this relation. This ratio represents the pounds of coal burnt per square foot of grate per hour in the same way as BD, or as better expressed $\frac{TD}{H}$, represents the water evaporation. It shows the reason why the E can steam and why the Q is not satisfactory; that the limitation for passenger service should be between 4 and 5 and for freight between 5 and 6. I believe this to be one of the most important ratios in the design of an engine and wish to emphasize its advantage over that of heating surface to grate area which I believe useless and as giving no reliable information, apart from these experiments.

It is not my desire to take the position that heating surface is of little value, certainly not on a solitary series of experiments carried out some years ago, but I have decidedly been led to think whether as a measure of capacity the grate area is not the most important factor.

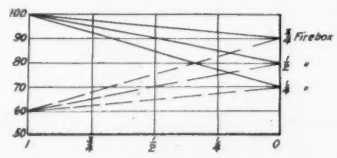


Fig. 3.

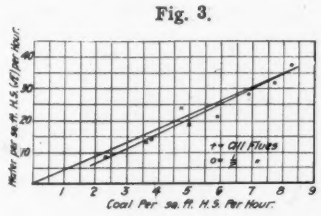


Fig. 6.

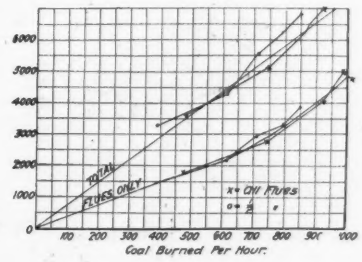


Fig. 7.

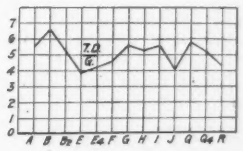
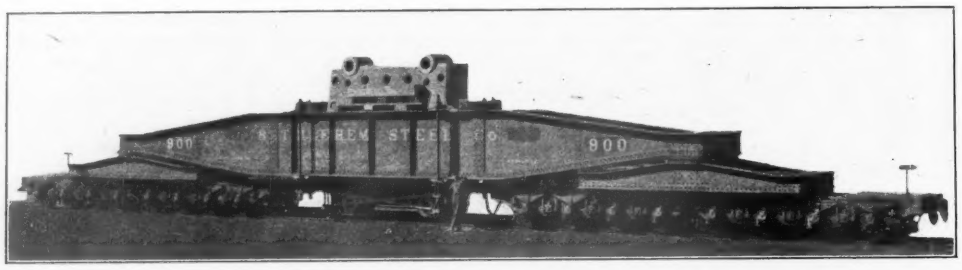


Fig. 8.

It does not follow that it is wise to make the grate too large. A large grate does not necessarily mean coal burnt and burnt well, and it is this that is wanted. I have noticed on the J engines that if the grate area is used the engines are excellent steamers, but that the grate area is frequently not used to burn coal evenly all over; a condition frequent with large engines with 50 or so square feet of grate. The physical limitations of the firemen must be reckoned with; but we should also watch the limitation of the grate and see that it is large enough to burn the coal required of it. In considering this question a number of facts have been explained to me by looking at heating surfaces in the light of these views; as, for instance, the action of engines in which we have decreased the number of flues, and the good steaming qualities of Pennsylvania class E2 engines, which have far less heating surface than other engines of the same type.

Heavy Flanging Press for the Baltimore & Ohio.

The Bethlehem Steel Company has recently built for the Baltimore & Ohio the heavy 12 ft. x 15 ft. flanging press which is shown herewith. This press is designed especially for flanging boiler plates and consists essentially of an upper and lower platen, a bed plate, hydraulic rams,



Top Platen of Flanging Press Loaded on 300,000 lbs. Capacity Car.

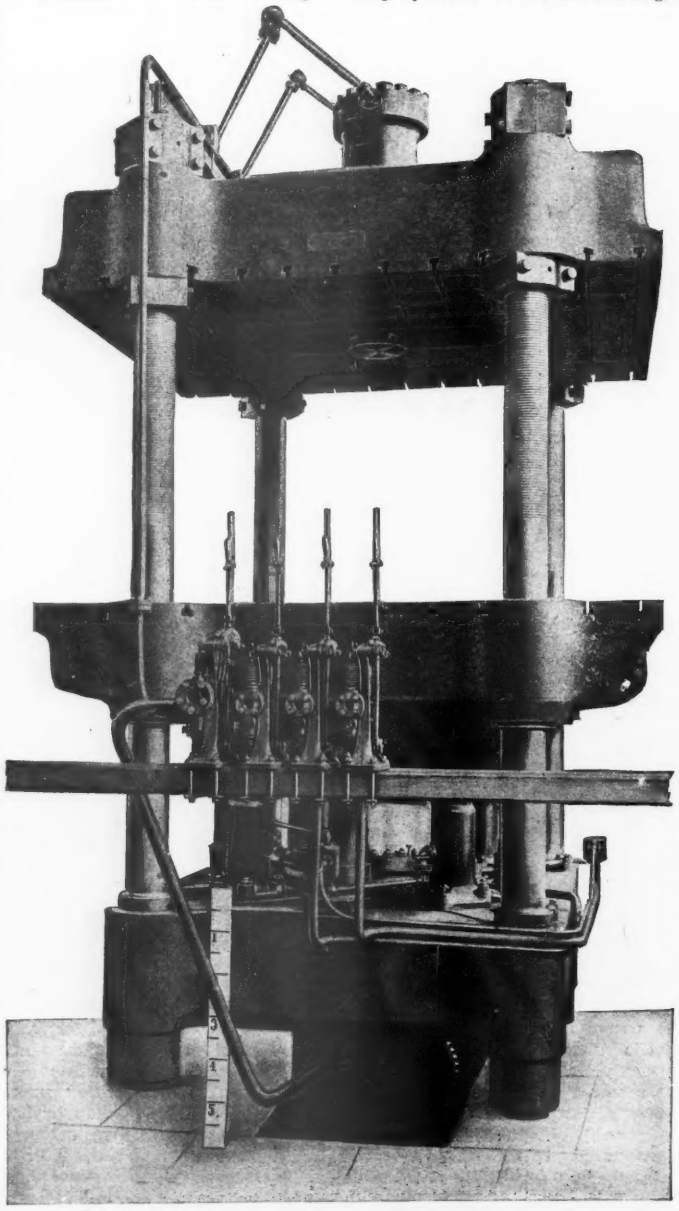
jacks and plungers. The main plunger is bolted to the bottom side of the lower platen and is bored to receive a 200 tons capacity vise-jack 19 in. in diameter and 36 in. stroke. The main cylinder is fastened to the bed plate and is 40 in. in diameter and 48 in. stroke—the capacity being 800 tons. On top of the main bed-plate are four jack-cylinders with a capacity of 50 tons each. These cylinders are 9½ in. in diameter and 24 in. stroke, and can each be moved radially 2 ft. 9 in. by means of a screw and ratchet hand lever. The main bed plate also contains sockets in which wooden buffers are placed to soften the shock of the return stroke of the platen.

The lower platen is guided by four 12-in. columns. The upper platen is fastened to these columns by means of split nuts bolted together in order to insure proper clamping. The top cylinder, which can be moved laterally 2 ft. 8 in., is 19 in. in diameter and has a 36-in. stroke. The plunger of this cylinder is bored to receive a pull back ram with a capacity of 45 tons, which can be increased if necessary. The ram works in guides to prevent turning. Both upper and lower platens have planed T slots in both directions for fastening the dies.

The press rests on four cast iron foot posts and is operated by four hand levers, which control the hydraulic valves in the pipes leading to the several cylinders. The bedplate and both platens are made of gun iron, the cylinders, plungers and glands are cast steel, the columns are fluid-compressed open-hearth steel, the bushings are composition metal and the glands are lined with composition metal.

The total weight of the press is 560,000 lbs., and the bedplate and upper and lower platens are each made in one piece. The top platen has overall dimensions of 14 ft. 9 in. x 15 ft., and is 3 ft. 4 in. thick and weighs 119,780 lbs. One of the illustrations shows the top platen loaded on the Bethlehem Steel Company's special 300,000 lbs. capacity car. This car was described in the *Railroad Gazette*, July 10 and July 17, 1903, and has the following general dimensions: Distance between centers of king bolts, 64 ft.; length of bridge truss, 66 ft. 10 in.; height of bridge truss, 6 ft. 10 in.; length of car over couplers, 103 ft. 10½ in.; total height of car, 10 ft. 2¼ in.; width of car, 9 ft. 9 in.; weight of car, 196,420 lbs.

In February no progress was made on the north end of the Simplon Tunnel and the advance at the south end was 441 ft.



Heavy Flanging Press for the Baltimore & Ohio.

TECHNICAL.

Manufacturing and Business.

On May 1 the executive and financial offices of the Louisville & Nashville in New York City will be removed to the Empire Building, 71 Broadway.

The Atha Tool Company, of Newark, N. J., is about finishing additions to its shops and will soon put up a new building across the street from the present shops.

The Birmingham Steel & Iron Company, of Birmingham, Ala., proposes to build a 10-ton furnace for making steel castings. C. H. McMillan will have charge of the work.

Frank B. Stone, hardwood and pine lumber, Chicago, has removed his office from the Fisher Building to suite 701 Railway Exchange, corner Michigan and Jackson boulevards.

The McCullough-Dalzell Crucible Company, Pittsburg, Pa., during the year 1903 imported from Ceylon 5,606 barrels of plumbago. This is the third largest importation during that year.

The Board of Estimate in New York City, April 15 approved appropriations for Atlantic avenue improvements, $100,000; aqueduct work, $500,000; docks $1,000,000, and for the Williamsburg Bridge awards $2,000,000.

The Henry R. Worthington Hydraulic Works, Brooklyn, N. Y., will shortly be removed to Harrison, N. J., to occupy the new $2,000,000 plant of the International Steam Pump Co., now nearly completed. The Brooklyn site consists of about 4½ acres, while the Harrison plant is on a 35-acre tract and contains 18 acres of floor space. The Worthington Company is one of the oldest and largest manufacturing concerns of Brooklyn, having been founded in 1843 by Henry R. Worthington, the inventor of the duplex steam pump and other hydraulic devices. About 2,000 men are employed in the South Brooklyn Works, while the Harrison works will accommodate from 5,000 to 6,000 men. The Brooklyn works will probably be sold the company having already disposed of its large foundries at Elizabethport, N. J.

The T. H. Symington Company now manages its own sales business in Chicago territory, taking the place of the Railway Appliances Co., agents. The Chicago office will be at Room 315, Railway Exchange, and will be in charge of E. H. Symington.

The Martin car heating system will be used on 14 locomotives recently ordered by the Terre Haute & Indianapolis and also on the locomotives which will be exhibited by the New York Central and the Lake Shore & Michigan Southern railroads at the St. Louis Exposition.

The Siamese State Railway is forwarding to the State Department at Washington specifications for a large supply of rolling stock, including 187 cars of various kinds and a large number of separate parts, such as brakes, wheels, etc. It is expected that locomotives and iron bridges will also be wanted.

The Harris Palatial Car Company has been incorporated by Louis E. Rich, Louie J. Harris, W. Myron Reynolds, J. H. Fowler, Jr., of New York City, and Frank H. Wendell, Fairview, N. J., with a capital stock of $1,000,000. The company intends to build palace, passenger and freight cars, and make car trucks and frames.

The American Bridge Company, it is reported, has been awarded the contract by the Chicago & North Western for the iron work of its new office building in Chicago, a note of which is given below. It is estimated that the building will require about 9,000 tons of structural material. The same company, it is also reported, has secured a contract from the Japanese Government for 15 steel bridges.

Iron and Steel.

Garrett & Hawk, of Mexico City, it is reported, in order to complete contracts, will require about 60,000 tons of structural steel.

The Tennessee Coal and Iron Co. now has eight of its ten open-hearth furnaces at Ensley in operation and will soon have the entire plant going.

Negotiations, it is reported, are again under way for the absorption of the Clairton plant of the Crucible Steel Company of America by the United States Steel Corporation.

At the third annual meeting of the United States Steel Corporation, held in Hoboken, N. J., April 18, the following directors were re-elected: J. Pierpont Morgan, Henry H. Rogers, E. H. Gary, George W. Perkins, Chas. M. Schwab, Henry Phipps, E. C. Converse and James Gayley.

New Office Building for the Chicago & North Western.

Work has begun on a new office building in Chicago for the Chicago & North Western. It is at the corner of Jackson boulevard and Franklin street. It will have a frontage of 105 ft. on the former and 165 ft. on the latter street and will be 14 stories high. There will be an inner court 81 ft. x 40 ft. and each floor will have over 10,000 sq. ft. of office space. The building will rest on caissons of which there will be 50. The foundation and frame are designed for 18 stories, though the upper four stories will not be built at present. The 14th floor will have a large dining room, 38 ft. x 75 ft., where it is said the employees will be served their noon luncheons free of cost. This floor will also have writing, reading and library rooms. Frost & Granger, Chicago, are the architects.

Yellow Semaphore Blades on the Pennsylvania.

After the end of this month, the blades of all semaphore signals on the lines of the Pennsylvania Railroad east of Pittsburg and Erie will be changed in color to conform to the standards on the Pennsylvania Lines West of Pittsburg. All home and dwarf signal arms will have square ends and the fronts of these arms will be painted yellow with a black stripe 5 inches wide about a foot from the end and parallel with it; the backs will be painted black with a white stripe similar to the black stripe on the front. Distant signal arms (with fish tail ends) will be painted yellow with black fish tail stripe about 3½ inches wide and same distance from the end as the home signals; back, black with white stripe similar to the black stripe on the front.

A meeting of superintendents which was held at Pittsburg last week, with Robert Pitcairn presiding, is said to have taken action looking toward the unification of the train rules throughout the lines of the Pennsylvania. The standard code is used both east and west of Pittsburg, but there are details in which the code of the lines east differs from that of the lines west.

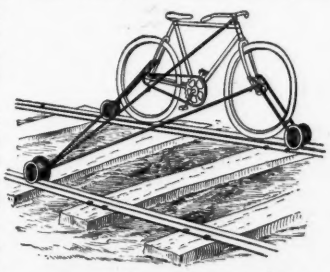
Electro-Pneumatic Interlocking at St. Louis.

The large new Westinghouse electro-pneumatic interlocking machine, which is to supplant the present machine at the Union Station, St. Louis, has just been set up. This is the largest power interlocking machine that has ever been built, having 215 levers, which perform as many functions as are usually covered by 600 or more levers in a purely mechanical (manual) machine. The frame of the St. Louis machine is 45 ft. long. In consequence of changes in the track plans at the station, which were insisted on by the railroad companies after the order was given, the construction of this machine has been much

delayed, the Terminal Railroad Association being forced to order three successive changes in the locking sheet. Each of these revisions took several weeks, and work on the machine at the Swissvale shops had to be kept up nights and Sundays. When the machine was finally ready it was sent by a fast passenger train, officers of the Pennsylvania having set an express car at the loading platform at the shops and having heartily co-operated in other ways with the Union Switch & Signal Company in saving all the time possible. The machine was loaded on the afternoon of Thursday and on Saturday it was standing on its feet in the tower at St. Louis.

Harris Railroad Bicycle Attachment.

The engraving shows the Harris improved railroad bicycle attachment. It is made to attach to any bicycle quickly and to fit any railroad track. It holds the front wheel stationary, relieving the rider of any effort to keep his machine on the tracks. The trolley or guide-wheel is all-steel and flanged, and though extremely light, is practically unbreakable.

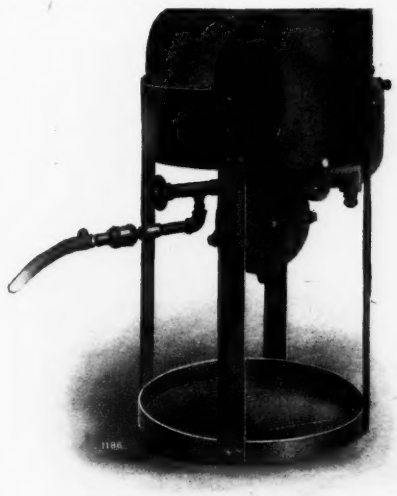


The attachment is furnished with or without the small guide wheels in the front and rear of the bicycle. If the latter are used they can be raised up and fastened to the bicycle when riding in the road. The braces and trolley wheel, when not in use, can be carried in a case that is supplied with the apparatus. The braces telescope, and the whole attachment, not including the small wheels, weigh only 7¼ lbs. A speed of 20 to 40 miles an hour is easily attainable, it is claimed. Freight or baggage weighing 100 lbs. or more can be carried in addition to the rider.

The attachment can be fastened to either side of a bicycle, though the side opposite the chain is preferable, as there is then no liability of the foot getting caught in the moving gear. The attachments are made by E. T. Harris, 531-45 West 15th street, Chicago.

The Macdonald Rivet Forge.

The accompanying illustration of the Macdonald forge shows another adaptation of compressed air for labor-saving devices. The forge is utilized for heating rivets and is handy and efficient in connection with any general outside steel construction work where pneumatic tools are used and compressed air is available. Instead of the



blast for blowing the fire being produced by a boy operating a wheel or lever to rotate the blower, the blower is revolved by a small jet of compressed air striking against the wings or blades of the blower fan and the speed of blower fan can be adjusted by means of a needle valve to give the desired degree of blast on the fire. The ordinary coal fire is used and the amount of compressed air required to operate the forge is from 5 to 7 cu. ft. of free air per minute. The forge is in general use in Great Britain and the Continent in the shipyards, bridge shops, boiler shops and general engineering plants. The Ingersoll-Sergeant Drill Co., New York, has obtained the sole right to manufacture and sell the forge in this country and Canada.

THE SCRAP HEAP.

Notes.

The Bell Telephone Company, at Toledo, Ohio, has established a telephone exchange for the exclusive use of the local freight agents and yardmasters of the railroads of the city.

A press despatch from Springfield, Ill., April 17, says that in the United States Court for that district the Terminal Railroad Association of St. Louis has been fined $400 and costs for having cars in use not provided with automatic couplers, in accordance with the law of 1893.

The Railway Ticket Protective Bureau has sent a circular to all railroads recommending that during the season of the World's Fair special tickets to or from St. Louis taken up on trains be promptly scrutinized by the auditor's office, so that forgeries may be discovered and investigated before it is too late to catch the forgers.

The State Railroad Commissioners of New York announce that they will hereafter have an office in New York City, at the Whitehall Building. Propositions to increase the membership of this board from three to five, and to empower it to enforce its decisions, have just been considered by the legislature and have been rejected.

The Interstate Commerce Commission has decided to investigate the differential question, which for several months has been disturbing New York and Philadelphia, and will give a hearing in New York City on May 18. The announcement says that rates on foreign and domestic traffic in both directions to and from all the Atlantic ports from Montreal and Halifax to Norfolk, Va., will be considered.

It is announced that the rule under which the railroads running fast trains between New York and Chicago refund a part, or all, of the excess fare, in case the train is behind time, has been simplified, making the recovery of excess by passengers easier. Hereafter, conductors of delayed trains will give to the passenger a rebate check which can be cashed at any ticket office of the road issuing it. The standard time between New York and Chicago is 28 hours, and the standard fare by the standard roads, $20. The excess fare is $1 for each hour saved.

A large majority of the employees of the elevated railroads in Manhattan (operated by the Interborough) have voted that they do not want a relief association such as has been proposed by the company. The proposition was not, as has been stated, for a pension system, but for a relief association, the funds to be contributed by the employees themselves. The opposition to the plan appears to be based largely on the fact that the locomotive runners, the firemen and the conductors and guards, and also other classes of employees, have mutual benefit departments in their brotherhoods. They fear that the railroad company is by this move trying to weaken the brotherhoods.

Railroad Commissioner Thomas, of Wisconsin, has made a report to the Governor of his findings in pursuance of the order of the legislature to examine the reports of the railroad companies for evidence of payments which have been made as rebates on freight. He has found that during the years 1901 and 1902 the Chicago & North Western, the Chicago, Milwaukee & St. Paul, the Chicago, St. Paul, Minneapolis & Omaha, and the Minneapolis, St. Paul & Sault Ste. Marie, paid to shippers in Wisconsin over $1,298,000 in rebates and "failed to report other gross earnings amounting to more than $400,000, making a total of $1,698,076.73, which they received in gross earnings, but which they wholly failed to report," and on which the taxes due to the state of Wisconsin amount to $67,923.07.

The Railroad Commissioners of Mississippi have adopted an order requiring railroad companies to use glasses for drinking water on all passenger trains. This action appears to have been taken in order to more effectively cope with the wicked designs of the microbe that crawls under the folded-over edge of the tin cups, which are the common drinking vessels on passenger cars at present. When he makes his nest on the edge of a tumbler you have a fair chance at him. The reporter of the Jackson *Clarion* surmises that the proper interpretation of this order will necessitate the use of cut glass tumblers, although he takes care to note that the commission has not yet officially authorized such an interpretation. "Cut glass," says the reporter, "will afford great satisfaction to people who have cut-glass tastes, but have to live on tin-cup incomes, and the order will be 'joyous news' to those passengers who have never before had an opportunity to drink out of a real glass."

The St. Louis Southwestern, known as the Cotton Belt, lately closed its offices in Memphis, Tenn., and "suspended connection with the city" because of some disagreement with the Memphis freight bureau regarding tariffs from that city to certain points in Arkansas; but, on April 18, after staying out less than two weeks, the company resumed its former relations. It is said that the questions at issue will be referred to the Interstate Commerce Commission for arbitration. The newspapers have had much to say about the reduction in the number of railroads in Memphis which was threatened by this action of the Cotton Belt, but it appears that the connection of the railroad with the city consisted only in the maintenance of freight and passenger offices, the actual transportation of the persons and property from the city to the Cotton Belt line at Fair Oaks, 60 miles, being in the trains of the St. Louis, Iron Mountain & Southern. This road and the Cotton Belt are owned in practically the same interest, and therefore are not likely to be actual competitors.

The war in grain rates from Lake Erie ports to New York and Philadelphia has been temporarily settled by referring the question for arbitration to Mr. C. C. McCain, Commissioner of the Lake Lines' Association, and he has promptly decided that the rates shall be the same to Boston, New York, Philadelphia and Baltimore. This arrangement will no doubt stand until a decision is given by the Interstate Commerce Commission, which is to investigate the subject, beginning May 18. The restoration will take effect April 30, and the rate on wheat will be 4 cents a bushel, as compared with 6 mills, the rate which has prevailed for the past few weeks, and with 4.6 cents, the rate to New York before the war began. As has already been stated, the "war" has been mostly on paper, very little grain having been moved during the past three months. The rate on corn will be 3.75 cents and on the other grains in proportion. It is said that the New York Central forced the present agreement by announcing, at Chicago, that if the rates on lake grain from Buffalo were not restored, an all-rail rate of 12 cents per 100 lbs. from Chicago to New York would be made on the opening of navigation.

A Hero Fund.

Mr. Andrew Carnegie has put in the hands of a board of trustees, at Pittsburg, a fund of $5,000,000, the proceeds of which will be used to furnish gratuities, or medals, or both, to persons who risk their lives to save the lives of others, or to the widows and next of kin of such persons when the hero himself loses his life. Elaborate rules are laid down for the conduct of the fund, and it appears that it is to be confined to civil life, excluding soldiers in the army and sailors in the navy. Mr. Carnegie's letter to the trustees names certain classes in which heroism may be looked for; as, for example, doctors and nurses in times of unusual danger. Many heroes are to be found, he says, in the railroad service. Mr. Robert Pitcairn, of Pittsburg, Assistant to the President of the Pennsylvania Railroad, is one of the trustees.

Railroad Competition Driving Out Lumber Vessels.

In five years the lumber shipments to Milwaukee by lake will have almost disappeared. The Forster Lumber Company owns its own boats, but has found it more profitable to ship the larger portion of its lumber by rail instead of by lake. The timber receipts at Milwaukee by lake for the year 1903 showed a falling off of almost 30 per cent. in comparison with 1902. The receipts by rail increased during the same year, until now they exceed the lake receipts. The forests are being cut each year farther from the lake ports, but their distance from the railroads remains about the same. This, however, is but a small item in the matter. The real reason that the lumber business of Lake Michigan will grow smaller each year is because the competition of the railroads is fast driving out the boats. The railroads are making a 10 cent rate to Milwaukee from Duluth and points in that neighborhood, and that is cheaper than the freight boats. Longshoremen demand as high as 55 cents an hour to load a boat, while the same men will load a car for 17½ cents an hour. And it costs more to unload the boat; insurance must be figured in. This is borne by the shipper on the lake, while the railroad company must pay the damages if anything happens to a car that goes by rail.—*Interview with C. G. Forster.*

The Mersey Railway.

Although the figures recently given by Mr. Kirker regarding the results obtained from electrification were very satisfactory from an engineer's point of view, they do not show up to so much advantage when set out in the cold record of a directors' report which considers the position from a dividend-earning standpoint. The half year ended December 30 had an electric train mileage of 401,046, compared with a steam train mileage of 155,039 in the corresponding half of 1902. The following figures show the position comparatively:

	Steam (1902).	Electric (1903).
Passengers	2,844,708	4,153,777
Totals receipts	£29,470	£37,358
Working expenses*	£21,992	£28,203
Working expenses, per cent.	74.63	75.50
Pumping, ventilation and lifts.	£6,089 or 20.66 p.c.	£4,237 or 11.34 p. c.

*Exclusive of pumping, ventilation and lifts.

It is stated that the working expenses include certain items of exceptional expenditure which are incurred because of delay on the part of the contractors in completing the works, and questions have in consequence arisen between the company and the contractors, which have had to be referred to arbitration. The figures, therefore though they relate to the first complete half year of electrical locomotion, cannot fairly be taken as a basis for comparing steam and electrical working. The current half will be a safer period upon which to base such calculation.

Electric Service on the North-Eastern.

The public service of electric trains on the North-Eastern Railway (England) was inaugurated on March 29, between Newcastle and Benton. The trial trip took place last September, and during the past three months experimental runs have been made on the section running through the populous suburban district from Newcastle to Tynemouth, a distance of 8½ miles. The first train was started by Lord Ridley, Chairman of the North-Eastern Company, in the presence of a distinguished gathering. The journey to Benton, a distance of between four and five miles, was made in 11 minutes, a saving of four minutes on the steam train time, and the return journey was run at express speed in eight minutes. As with the electric trains on the elevated roads in New York, the thing which chiefly impressed the passengers was the rapid acceleration, the smooth running, and the ease with which the train could be brought to a full stop. The first regular public train left three-quarters of an hour after the special carrying the officials, with over 200 passengers, and the 15-minute service was continued from that time throughout the day. The North-Eastern has issued a time-table of the electric service, dated March 26, in ac-

cordance with which trains are run for the most part at a 15-minute interval from 6 o'clock in the morning until 11 o'clock at night. The standard train is made up of three cars, of which one is a combined baggage, first class and smoker; one a third class ordinary coach, and one a third class smoker.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page 16.)

American Society of Civil Engineers.

At the meeting held April 20, a paper was read on "Lateral Earth Pressure and Related Phenomena," by E. P. Goodrich.

Western Society of Engineers.

At the meeting of this society at Chicago on Wednesday evening last, Mr. G. E. Ellis, of the Pneumatic Signal Company, read a paper on "Railroad Signaling." Mr. Ellis devoted his attention principally to interlocking and touched upon block signaling briefly. He understands the details of his subject very thoroughly and explained them in an entertaining manner. The paper was illustrated by drawings and photographs, and, on subjects concerning which there are marked differences of opinion and practice, he put the facts, in lucid shape, showing the reasons for the prevailing lack of uniformity. Mr. Ellis says that one of the Toucey & Buchanan interlocking machines put up on the New York Central about thirty years ago, is still in use at Batavia, N. Y.

The American Street Railway Association.

The 23d annual convention of this Association will be held in Recital Hall, Festival Hall Building, World's Fair Grounds, St. Louis, Mo., October 12 and 13. The Mechanical and Accountants' associations will meet the same week at the same place. No exhibits will be displayed by this Association this year. The headquarters of the Association will be at the Southern Hotel. A limited number of rooms will be reserved at the downtown hotels, if applied for before June 1, at from $5 to $15 a day. Wednesday, October 12, has been set apart as "Street Railway Day," and special attractions will be furnished by the Exposition authorities. The banquet will be held Thursday evening, October 13. The chief officers of the different companies are requested to notify delegates and heads of departments attending the convention that they will be expected to attend each session and take part in the discussion, that hereafter at each session of the convention the roll of delegates will be called at the time meeting is called to order, and that the roll call will be published in the minutes of the meeting.

Iron and Steel Institute.

The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George street, Westminster, London, on May 5 and 6. At this meeting reports for the year 1903 will be presented by the Council; also by the Treasurer. The election of officers will follow. The Bessemer Gold Medal for 1904 will be presented to R. A. Hadfield, Vice-President, and the awards of the Andrew Carnegie Gold Medal and Research Scholarships for 1904 will be announced. The following papers will also be presented: "On Pyrometers suitable for Metallurgical Work," by the Committee; "On Coke Ovens," by C. Lowthian Bell; "On Troostite," by H. C. Boynton; "On the Range of Solidification and the Critical Ranges of Iron-Carbon Alloys," by H. C. H. Carpenter and B. F. E. Keeling; "On Explosions Produced by Ferrosilicon," by A. Dupre and Captain M. B. Lloyd; "On the Thermal Efficiency of the Blast-Furnace," by W. J. Foster; "On the Production and Thermal Treatment of Steel in Large Masses," by Cosmo Johns; "On the Manufacture of Pig-Iron from Briquettes at Herrang, Sweden," by H. Louis. Reports on research work carried out during the past year will also be submitted.

PERSONAL.

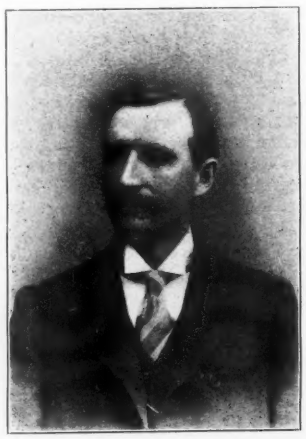
—Mr. John W. Van Valkenburgh, who many years ago was Superintendent of the Albany & Susquehanna, died at his home in Albany, N. Y., on April 13, at the age of 78. In 1880 Mr. Van Valkenburgh was Receiver of the Lebanon Springs Railroad.

—Captain William H. Green, Assistant to the General Manager of the Southern Railway, died at his home in Washington, D. C., on April 16. Mr. Green was 66 years old, and had been in failing health some time. He was born in Richland District, S. C., and had been connected with the Southern for many years. He began work as a water boy in the shops of the Charlotte & South Carolina. Then for about 10 years he was on the Wilmington & Manchester. For five years from 1870, he was Master of Transportation on the North Carolina, and in 1875, was appointed Superintendent of the Richmond & Danville. In 1888 he was made General Superintendent of this road, the title of Assistant General Manager being added in 1890. Later he was made General Manager, and in 1894 was promoted to be the General Manager of the Eastern System of the Southern. He afterwards became General Superintendent of the system and in 1898 was made Assistant General Manager, but in a few years ill health compelled him to take lighter duties and he became Assistant to the General Manager, the position he held at the time of his death.

—Mr. Robert Sample Miller, who was closely identified with the department of Mechanical Engineering of Purdue University, died recently in La Fayette, Ind. He was born in 1876, and at the age of 14 entered the senior preparatory school at Purdue. Five years later he graduated from the university and for three years was employed as a special assistant and computer in the office of the department of Mechanical Engineering. While there he assisted in making important tests on the Purdue locomotive. In 1898 he was appointed Assistant in Mechanical Engineering and a year and a half later was made Assistant Professor of Machine Design. In 1901 he was promoted to be Associate Professor of Machine Design which position he held until near his death. In 1902 he went to Colorado on account of failing health, but soon accepted an appointment as Professor of Mechanical Engineering in the University of Colorado at Colorado Springs, but his health continued to fail and he soon had to give up his position. Mr. Miller was a deep student and an indefatigable worker. He had a brilliant mind and accomplished much in his chosen field. He was a Junior member of the American Society of Mechanical Engineers.

—Mr. Albert E. Mitchell, who on Monday next becomes Superintendent of Motive Power of the Lehigh Valley to succeed Mr. Taylor, has for the past year or so been Superintendent of Motive Power of the Northern Pacific. Mr. Mitchell graduated from the Maine State College, Orono, Me. (Mechanical Engineer), class of 1875. The following year he worked as an apprentice in the Baldwin Locomotive Works. In 1877 he went to the Pennsylvania Railroad, where he worked in the testing and signal departments at the Altoona shops until 1881. During the next five years Mr. Mitchell was with Yale & Towne and other manufacturing companies and with the New York & New England Railroad. In the fall of 1886 he went to the New York, Lake Erie & Western, where he was Engineer of Signals at New York and Mechanical Engineer on the Chicago & Erie. In 1892 he was made Superintendent of Motive Power of the entire system. About three years ago he left the Erie and went to the Chicago, Milwaukee & St. Paul as Assistant Superintendent of Motive Power, but in less than a year he resigned to become Superintendent of Motive Power on the Northern Pacific, succeeding Mr. Lovell. This office he now leaves to come east. His office will be at South Bethlehem, Pa. During his long service on the Erie Mr. Mitchell became very well known throughout the Eastern states, as well as prominent in the Master Car Builders' and Master Mechanics' associations. He was also active in the New York Railroad Club and did important work in all these associations.

—Mr. E. N. Brown, who has been chosen to succeed Mr. Raoul as President of the National Railroad of Mexico, has for the past two years been Second Vice-President and General Manager of this company. Mr. Brown was born in Barbour County, Ala., 42 years ago. He began his railroad career on the Richmond & Danville and was successively Rodman, Levelman, Transitman and Chief of locating party. Later he took a position on the Central of Georgia as Resident Engineer and Division Engineer, and remained with this company, working on various pieces of construction work, until 1887, when he took charge of the building of the Mexican National from Saltillo to San Luis Potosi. On this road he was soon made Division Superintendent. In 1890, he was transferred to the Southern Division of the National, with office at City of Mexico. Three years later he was promoted to be General Superintendent. This position Mr. Brown held until 1901, when he was made Third Vice-President and General Manager. In May the following year (1902) he was made Second Vice-President and General Manager, which position he now leaves to become the executive head of the company.



—Mr. J. P. Douglass, General Agent of the Colorado & Southern, with office at New Orleans, La., died suddenly at Fort Worth, Texas, on April 9, at the age of 37.

—Mr. John Mackrille, at one time Auditor of Freight Receipts of the New York, New Haven & Hartford, died at his home in West Haven, Conn., on April 13, at the age of 60.

—Mr. J. E. Duval, who has just been appointed Inspector of Railway Accidents by the Canadian Government, began railroad work when 14 years old as a night operator on the Detroit Division of the Grand Trunk, and for 18 years was on the Canada Atlantic as Chief Train Despatcher. About three years ago he was promoted to the position of Car Service Agent. Mr. Duval's three brothers are in railroad work and his father recently retired from active service after nearly 40 years' service on the Grand Trunk.

—Mr. E. O. McCormick, the new Assistant Traffic Director of the "Harriman Lines" (Southern Pacific, Union Pacific, Oregon Railroad and Navigation Company and the Oregon Short Line), was born at La Fayette, Ind., in 1858. He was educated at the La Fayette High School, and began railroad work in the construction department of the Lake Erie & Western, in 1879. He was successively General Agent in the freight department of the Louisville, New Albany & Chicago; General Agent of the Great Eastern Freight Line and City Passenger and Ticket Agent and General Northwestern Passenger Agent of the Chicago, Indianapolis & Louisville. In May, 1889, he was made General Passenger Agent of the Cincinnati, Hamilton & Dayton, and four years later resigned to go to the Cleveland, Cincinnati, Chicago & St. Louis at Passenger Traffic Manager. In 1899 he went to the Southern Pacific Company in a similar position, which office he held until April of this year, when he was promoted to be Assistant Traffic Director (Freight and Passenger) of the Harriman Lines.

—Mr. B. A. Worthington, who recently went from San Francisco to Chicago as Assistant Director of Maintenance and Operation of the "Harriman Lines," is a native of California, having been born in Sacramento in 1861. Mr. Worthington's railroad experience dates from 1874, when he began as a telegraph messenger on the Central Pacific. Afterward he was an operator at various points. For a time he was Chief Operator in the Western Union office at Los Angeles; but in 1882 returned to railroad work as Chief Clerk to the General Master Mechanic at Sacramento. In 1888 he was appointed Chief Clerk and Secretary to the Vice-President and General Manager, later becoming Secretary to H. E. Huntington, who was then Assistant to the President of the Southern Pacific Company. In August, 1901, he was promoted to be Superintendent of the Tucson Division, but two months later was put in charge of the Coast Division at San Francisco. In 1903 he was made Assistant to the General Manager, and received his new appointment as Assistant Director of Maintenance and Operation on the first of this month.

—Mr. Carl Raymond Gray, the new General Manager of the St. Louis & San Francisco, is about 37 years old. As General Manager of this company Mr. Gray will have charge of the transportation and motive power departments. He was educated at the Arkansas Industrial University and has spent the past 22 years on the "Frisco," beginning as a telegraph operator in 1882. For four years he served as operator and agent. Then for a year he was in the traffic department as a clerk. In 1887 he was appointed commercial agent at Wichita. In 1890 he was made division freight agent and in October, 1897, was promoted to be Superintendent of the Western Division at Monett. This position he held for three years, when he resigned to become Superintendent of Transportation, with office first in St. Louis and later at Springfield.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—J. W. Oplinger has been appointed Mechanical Inspector, reporting to R. E. Smith, Assistant to the General Manager. Mr. Oplinger's office will be in Wilmington, N. C. J. J. Thomas, Jr., has been appointed Master Mechanic of South Rocky Mount Shops, with jurisdiction over Machinery Department employees on Richmond, Norfolk, Fayetteville and Wilmington districts, including Wilmington Yard, succeed-

ing Mr. Oplinger. Mr. Thomas' office will be in South Rocky Mt., N. C.

Baltimore & Ohio.—W. H. Williams, Assistant to the General Manager, with office at Baltimore, has resigned.

Belington & Northern.—See West Virginia Central & Pittsburg.

Bessemer & Lake Erie.—E. B. Gilbert, hitherto Master Mechanic, has been appointed Superintendent of Motive Power.

C. L. Pasko, hitherto Trainmaster, has been appointed Assistant Superintendent of Motive Power.

Boston & Maine.—W. J. Hobbs, Comptroller and General Auditor, has been appointed Fourth Vice-President.

Chicago & Alton.—See Rutland.

Chicago, Rock Island & Pacific.—J. O. Crockett, for the past five months Assistant to the General Manager, has been appointed Superintendent of Mails and Telegraph, with headquarters at Chicago. Mr. Adams Superintendent of Telegraph, has resigned. Mr. Kearney, Supervisor of Mails, has resigned to go to the "Frisco." (See St. Louis & San Francisco.)

Federal District Street Railway (City of Mexico).—William W. Wheatly has been appointed General Manager, effective April 5.

Fort Worth & Rio Grande.—H. M. Fickinger has been elected Vice-President, succeeding L. B. Comer.

Great Northern.—E. L. Gilboy has been appointed Assistant Superintendent of the Superior and Mesabi divisions, with headquarters at Superior, Wis., succeeding C. O. Jenks, promoted.

Jacksonville & St. Louis.—L. W. Berry, hitherto Superintendent of the Chicago, Burlington & Quincy, at Beardstown, Ill., has been appointed Superintendent of the J. & St. L. W. E. Crane, General Manager, has resigned, and that office has been abolished.

Kansas City Southern.—Herrmann Sielcken has been appointed Vice-President, succeeding G. J. Gould, resigned.

Lehigh Valley.—A. E. Mitchell, hitherto Superintendent of Motive Power of the Northern Pacific, has been appointed Superintendent of Motive Power of the L. V., with headquarters at South Bethlehem, Pa., succeeding H. D. Taylor, resigned, effective April 25.

The general offices in New York City are to be moved from 26 Cortlandt street to 143 Liberty street. After April 24 the addresses of the President and the several other officers will be changed accordingly.

T. O. Cole, Superintendent of Car Service, has resigned.

Natchez, Red River & Texas.—O. O. Ogden has been appointed General Freight and Passenger Agent.

New Orleans Terminal.—See St. Louis & San Francisco.

Northern Pacific.—A. M. Cleland, hitherto Assistant General Passenger Agent, has been appointed General Passenger Agent, with headquarters at St. Paul, Minn., succeeding C. S. Fee.

A. E. Mitchell, Superintendent of Motive Power, has resigned. (See Lehigh Valley.)

Reading Company.—E. T. Stotesbury has been elected a Director, succeeding G. C. Thomas, resigned.

Rutland.—George L. Moore, hitherto Engineer of Maintenance of Way of the Chicago & Alton, has been appointed Chief Engineer of the Rutland, with headquarters at Rutland, Vt.

St. Louis & San Francisco.—J. F. Hinckley, hitherto Chief Engineer of the New Orleans Terminal, has been appointed Chief Engineer of the St. L. & S. F.; C. D. Purdon, hitherto Chief Engineer, has been appointed Engineer of Maintenance of Way; E. F. Kearney has been appointed General Superintendent of Transportation; all with office at St. Louis. C. F. Resseguie and S. L. Rainey have been appointed District General Superintendents, with headquarters at Springfield, Mo., effective April 12.

J. H. Ashley has been appointed Superintendent of Car Service, with office at Springfield. The office of Car Service Agent has been abolished.

Tennessee Central.—A. Philbrick has been appointed Chief Engineer, with headquarters at Nashville, Tenn., succeeding W. N. McDonald.

Texas & Pacific.—P. Harris has been appointed Superintendent, with headquarters at Marshall, Texas, succeeding E. W. Campbell.

West Virginia Central & Pittsburg.—Since the first of this month the Belington & Northern Railroad has been operated as a part of the W. V. C. & P. Per diem reports, junction reports and car tracers now go to J. W. Smith, Superintendent Car Service, Baltimore. Car repair bills to I. N. Kalbaugh, Superintendent of Motive Power, Elkins, W. Va., and remittances to J. T. M. Barnes, Treasurer, Baltimore, Md.

LOCOMOTIVE BUILDING.

The Southern Indiana is having five locomotives built at the Baldwin Locomotive Works.

The Detroit & Toledo Shore Line has ordered six compound mogul (2-6-0) locomotives from the Baldwin Locomotive Works, for April, 1904, delivery. The tank capacity of these locomotives will be 6,000 gallons of water and coal capacity 10 tons.

The Chicago, Milwaukee & St. Paul, as reported in our issue of April 15, is about to build 15 simple 10-wheel (4-6-0) freight locomotives and 15 passenger locomotives at its West Milwaukee shops. The freight locomotives will weigh 158,900 lbs., with 135,555 lbs. on drivers; cylinders, 21 in. x 30 in.; diameter of drivers, 68 in.; extended wagon-top boiler, with a working steam pressure of 200 lbs.; heating surface, 2,946 sq. ft.; 350 tubes, 2 in. in diameter and 15 ft. long; steel fire-box, 119¾ in. long and 41⅛ in. wide; grate area, 34 sq. ft.; tank capacity, 7,000 gallons of water, and coal capacity 10 tons. The type of the 15 passenger locomotives has not yet been fully decided.

The Canadian Pacific, as reported in our issue of April 8, has ordered 11 simple consolidation (2-8-0) locomotives from the Canadian Locomotive Co., Kingston, Ont., and 10 simple Consolidation (2-8-0) locomotives from the Canadian Works of the American Locomotive Company, for July and August, 1904, delivery. These locomotives will weigh 182,000 lbs., with 157,000 lbs. on drivers; cylinders, 21 x 28 in.; diameter of drivers, 57 in.; radial-stayed boiler, with a working steam pressure of 200 lbs.; fire-box, 96 in. long and 66 in. wide; grate area, 44 sq. ft.; tank capacity for water 5,000 gallons, and coal capacity 12 tons. The special equipment includes: Little Giant bell ringers, Magnesia boiler lagging, Simplex brake-beams, Washburn couplers in front and Tower couplers behind, Hancock injectors, U. S. metallic piston rod and valve-rod packings, Wilson's sanding devices, crucible steel springs, Utica steam gages, C. P. R. standard brake-shoes and journal bearings, cast-steel wheel centers, Schmidt superheating device and combined automatic and straight-air air-brakes.

The Santa Fe, Prescott & Phoenix, as reported in our issue of April 1, is having three simple consolidation (2-8-0) locomotives built at the Brooks Works of the American Locomotive Co., for May 5, 1904, delivery. These locomotives will weigh 144,000 lbs., with 128,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 50 in.; radial stayed extended wagon-top boiler, with a working steam pressure of 180 lbs.; 256 charcoal iron tubes, 2 in. in diameter and 13 ft. 1⅛ in. long; Otis steel fire-box, 108 in. long and 33 in. wide; tank capacity 5,000 gallons of water, and oil capacity 2,500 gallons. The special equipment includes: Westinghouse-American air-brakes, hammered steel axles, Gollmar bell ringers, Magnesia sectional boiler lagging, Sterlingworth brake-beams, Leeds couplers, Magnus and Ajax journal bearings, Sullivan piston-rod packings, Brooks valve-rod packings, Crosby safety valves, Leach sanding devices, Detroit sight-feed lubricators, Railway Steel-Spring Co.'s springs, American Locomotive Co.'s headlights and steam gages, Latrobe driving wheels, truck wheel and tender wheel tires, cast-steel wheel centers, and American Steel Foundries Co.'s truck bolsters.

The Southern has ordered 25 simple consolidation (2-8-0) locomotives and 19 simple Pacific (4-6-2) locomotives from the Baldwin Locomotive Works. The consolidation locomotives will weigh 200,000 lbs., with 180,000 lbs. on the drivers; cylinders, 22 in. x 30 in.; diameter of drivers, 56 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 3,517 sq. ft.; 437 tubes, 2 in. in diameter and 14 ft. 6½ in. long; carbon steel fire-box, 108 in. long and 72½ in. wide; grate area, 53 sq. ft.; tank capacity 6,000 gallons of water, and coal capacity 12½ tons. The Pacific locomotives will weigh 214,000 lbs., with 135,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 72 in.; straight boilers, with a working steam pressure of 220 lbs.; heating surface, 4,965 sq. ft.; 322 tubes, 2¼ in. in diameter and 20 ft. long; Lukens or Worth fire-box, 108 in. long and 72¼ in. wide; grate area, 54 sq. ft.; tank capacity 6,000 gallons of water, and coal capacity 12½ tons. The special equipment for both includes: Westinghouse American air-brakes, open-hearth steel axles, Gollmar bell ringers, Magnesia boiler lagging, National-Hollow brake-beams for consolidation locomotives and Diamond "S" brake-beams for Pacific locomotives, "Perfecto" brake-shoes, Tower couplers, Schroeder headlights for consolidation locomotives and Pyle-National electric headlights for Pacific locomotives, Hancock injectors, Ajax journal bearings, U. S. metallic piston and valve-rod packings, Coale safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway specification springs for consolidation locomotives and Railway Steel Spring Co.'s springs for Pacific locomotives, Ashcroft steam gages, Gold steam heat equipment for Pacific locomotives, Midvale driving and truck wheel tires, cast-iron tender wheel tires and cast steel wheel centers.

CAR BUILDING.

The Chicago & Alton has ordered one dining car from the Pullman Co.

The Southern Pacific has ordered six dining cars from the Pullman Co.

The American Car & Foundry Co. has miscellaneous orders for 100 cars.

The Chicago City Ry. is reported to be about to place an order for 40 cars.

The Cleveland Electric Ry. is about to let an order for a large number of cars.

The Grand Rapids & Indiana has ordered one passenger coach from the Pullman Co.

The Milwaukee Electric Ry. has ordered 30 street cars from the St. Louis Car Co.

The Fairfield-Cambria Coal Co. has ordered 100 hopper gondolas from the American Car & Foundry Co.

The Chicago, Burlington & Quincy has ordered 400 refrigerator cars from the American Car & Foundry Co.

The Baltimore & Ohio Southwestern is reported to be figuring on some new equipment for World's Fair service.

The Grand Trunk has ordered 10 60-ft. baggage cars from the American Car & Foundry Co., for July, 1904, delivery.

The Cold Blast Transportation Co. has ordered 100 beef refrigerator cars from the American Car & Foundry Co.

The Siamese State Railroads are reported to be asking bids on 187 cars of various kinds and on a number of separate parts, such as brakes and wheels.

The Chihuahua & Pacific has ordered 60 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co. The special equipment includes Standard couplers and Westinghouse air-brakes.

The Logan Coal Co., Philadelphia, has ordered 100 steel hopper gondola cars, instead of 150, as reported in our issue of April 15, of 100,000 lbs. capacity, from the Pressed Steel Car Co., for May, 1904, delivery.

The Canadian Pacific is building 20 baggage and express and 11 mail and express cars of 60,000 lbs. capacity at its Hochelaga shops. These cars will be 60 ft. long and 9 ft. 10½ in. wide. The special equipment includes: Westinghouse air-brakes, Tower couplers, Miner draft rigging, Gold heating system, McCord journal boxes and lids, acetylene gas with Pintsch fittings, four-wheel trucks and steel-tired wheels.

The Pennsylvania Lines West, as reported in our issue of April 8, have ordered 653 steel under-frame box cars, 261 steel under-frame stock cars, and 194 steel under-frame flat cars from the American Car & Foundry Co. They have also placed an order for 700 steel hopper cars and 403 steel gondolas with the Standard Steel Car Co. All of these cars will be built according to regular Pennsylvania standard specifications.

The Butte, Anaconda & Pacific, as reported in our issue of March 25, is having 75 steel ore cars of 100,000 lbs. capacity built by the Standard Steel Car Co. These cars will be 31 ft. 6 in. long, 10 ft. wide, and 8 ft. 6 in. high, with metal frames and under-frames. The special equipment includes: open-hearth steel axles, Standard brake-beams, cast-iron brake-shoes, Westinghouse brakes, Magnus brasses, Dowling couplers and Westinghouse frictional draft rigging.

Swift & Co., Chicago, is building 100 beef refrigerator cars of 60,000 lbs. capacity, at its shops, for May and June delivery. The cars will be 33 ft. long and 9 ft. wide. The special equipment includes: Bettendorf bolsters, Chicago Railway Equipment Co.'s brake-beams, Cardwell brake-shoes, Major steel couplers, Swift standard door fastenings and doors, Miner tandem draft rigging, National Malleable Castings Co.'s M. C. B. journal boxes, Swift & Co.'s standard paint and trucks, Marshall torsion proof roofs, Farist springs and Griffin wheels.

BRIDGE BUILDING.

ALGIERS, LA.—The City Engineer is preparing plans for building a viaduct to cost about $45,000.

ATLANTA, GA.—Plans are being made by Chief Engineer R. M. Clayton for building a steel viaduct over the railroad tracks at Magnolia street, to cost about $35,000.

BELLEVILLE, N. Y.—The bridge over the Moira River at this place, which cost $21,000, has been carried away by ice.

CALIFORNIA, MO.—Bids are wanted, April 26, for building a steel bridge 171 ft. long over Bunis Fork, in Moniteau County. C. W. Burford is County Clerk.

CARLISLE, PA.—A new bridge will be built by the Carlisle, Harrisburg & Chambersburg Turnpike Co. over Letart Spring, at Middlesex.

CINCINNATI, OHIO.—The Lockland swinging bridge over the canal is to be rebuilt at a cost of about $15,000.

EVERETT, WASH.—Bids are wanted, May 16, by the City Clerk, for building a steel drawbridge having a span of 233 ft. over the Smosnish River.

FREDERICTON, N. B.—C. H. La Billois, Commissioner of Public Works, is asking bids for rebuilding the Ryan bridge in the parish of Sussex and new steel bridge at Harshman's, parish of Shediac.

FULLERTON, NEB.—Bids are wanted, May 12, by S. Stephenson, County Clerk, for building a steel highway bridge over the Loup River, near Palma, in Nance County.

GREENFIELD, IND.—The County Commissioners will build a 600-ft. steel bridge over White River, for which plans are being made.

GUELPH, ONT.—The Guelph Township Council has decided to build a steel bridge at Amos.

HURON, S. DAK.—The Chicago & North Western will build a new steel bridge 240 ft. long on stone abutments over the Jim River.

INDIANAPOLIS, IND.—Plans are being made and $125,000 has been appropriated by the City Council, to repair bridges damaged by floods.

JERSEY CITY, N. J.—Bids are wanted, May 5, by the Board of County Freeholders for the Arlington avenue bridge improvements.

KALAMAZOO, MICH.—The City Council recommends a bond issue of $75,000 for dredging the Kalamazoo River and building a steel bridge at Gulf street.

KENOSHA, WIS.—Bids are wanted May 3, by Gus Jacob, City Clerk, for building the concrete steel bridge at Middle street.

LINCOLN, NEB.—Bids are wanted, May 7, by W. L. Dawson, County Clerk, for building all the bridges that may be needed in Lancaster County for one year.

LONDON, ONT.—Bids are being received by the Chelsea Greenland & Building Company for the erection of three steel spans of the Adelaide street bridge.

MADISON, IND.—An appropriation of $15,000 to repair bridges damaged by floods has been made by the County Council.

MATAWAN, W. VA.—On April 11 the United States bridge over the Tug Fork of the Big Sandy River, about Senate passed a bill authorizing the Blackberry, Kentucky & West Virginia Coal & Coke Co. to build a one mile east of Matawan, W. Va.

MINNEAPOLIS, MINN.—A bridge is proposed over the Northern Pacific tracks at Harvard street.

NOBLESVILLE, IND.—The County Commissioners will soon ask bids for repairs to bridges damaged by floods, for which an appropriation of $20,000 has been made.

ONEIDA, N. Y.—A scheme is under way to abolish grade crossings and build a bridge to carry Seneca avenue over the Ontario & Western tracks, at a cost of about $30,000.

OREGON, MO.—Bids are wanted, May 5, by C. S. Armstrong, Mound City, or E. A. Welty, County Clerk, at Oregon, for building about 30 bridges in Holt County.

OXBOW, N. W. T.—The Canadian Pacific steel bridge has had about 180 ft. washed away by recent floods, four smaller bridges have also been carried away in this section.

PAWTUCKET, R. I.—In the Common Council an ordinance has been voted providing for the issuance of $60,000 of bonds for bridge improvements.

POLAND, OHIO.—Bids are wanted May 10, by W. R. Leonard, County Auditor, at Youngstown, for rebuilding the bridge over Yellow Creek on Main street in Mahoning County.

PORTLAND, ORE.—The City Council is considering authorizing the construction of two steel bridges to cost $55,000 each, one to be on First street over Marpuam Gulch, and one on Grand avenue, over Sullivan's Gulch.

REDWOOD CITY, CAL.—Bids are wanted, May 2, by H. W. Schaberg, Clerk of the Board of Supervisors of San Mateo County, for building a steel and concrete bridge over Pescadero Creek.

ST. PAUL, MINN.—A committee has been appointed to urge the building of a bridge at Payne avenue and Beaumont street.

TACOMA, WASH.—Plans are ready for rebuilding the Eleventh street bridge at a cost of about $50,000. L. A. Nicholson is City Engineer.

TIVERTON, R. I.—A bill providing for a new bridge on the site of the present stone structure at this place has passed both houses of the State Legislature. It calls for a structure to cost about $100,000.

TYNDALL, S. DAK.—Bids are wanted, May 24, by Vale F. Kreycik, County Auditor, for building steel and pile bridges of various lengths in Bonhomme County over the Chicago, Milwaukee & St. Paul tracks.

VINCENNES, IND.—The County Council has appropriated $22,000 for replacing bridges damaged by floods.

WARREN, PA.—Bids are wanted, April 25, by the Bridge Committee for building a bridge over Conewango Creek at Third street; also a bridge over the same creek on Pennsylvania avenue. Frank Morrison is Chairman of the Bridge Committee.

Other Structures.

ALTOONA, PA.—The Pennsylvania's new wheel foundry is about completed, and will be ready for operation about June 1. The capacity of the new works will be about 900 wheels a day.

FALL RIVER, MASS.—The Old Colony Street Railroad Company has petitioned the Legislature for leave to acquire land for shops.

GALION, OHIO.—The Erie, it is reported, will build a new roundhouse with 50 stalls.

HELENA, MONT.—The Northern Pacific, reports say, will build a new roundhouse and car shops.

NEWARK, N. J.—The Delaware, Lackawanna & Western has filed plans with the Building Department for a two-story brick passenger station at Roseville avenue, to cost about $32,000.

NEW ORLEANS, LA.—The Louisiana Railway & Navigation Co., it is reported, has secured land fronting on the Mississippi River, 2,000 ft. and 2,100 ft. deep, on which it proposes to build elevators, wharves and warehouses.

PORTCHESTER, N. Y.—The New York, New Haven & Hartford is to build a new passenger station, on the south side of its tracks, for eastbound business. The probable cost is $30,000. Horton & Heminway, of Providence, R. I., are the architects.

ST. LOUIS, MO.—The Harrison Machine Works, it is reported, will build shops at a cost of about $50,000.

SECAUCUS, N. J.—The Delaware, Lackawanna & Western, it is reported, is making plans for building large car shops.

WASHINGTON, D. C.—The Sundry Civil Appropriation Bill as amended by the Senate Committee on Appropriations provides for a fireproof building for committee rooms, folding room and office rooms for Senators, to be built on the site bounded by B, First and C streets and Delaware avenue, N. E. This is north of the Capitol grounds, the site corresponding to that south of the Capitol grounds on which an office building for members of the House of Representatives is being built. The amendment appropriates $750,000, and provides that the building, exclusive of the site, shall cost not over $2,500,000, and the contracts shall be let and the building constructed under the control of the Superintendent of the Capitol building and grounds, subject to the direction and supervision of a commission to be composed of Senators Cullom, Gallinger and Cockrell.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARIZONA & CALIFORNIA.—This company has been incorporated in Arizona to build a railroad through Arizona and Southern California. The authorized capital is $7,500,000. F. M. Murphy and W. A. Drake, Prescott, Ariz., are incorporators.

ARKANSAS VALLEY & WESTERN (ST. LOUIS & SAN FRANCISCO).—Surveys are in progress for an extension of this road from Avard, Okla. T., west through the counties of Woodward and Beaver, to Hooker, in the northwestern portion of Beaver County. This new extension will be about 200 miles long. The main line of this road was recently completed from Vinita, Ind. T., to Avard, Okla. T.

BEE TREE.—It is stated that the contract will be let at once for building this proposed road from Swannanoa, N. C., to Craggy Mountain, eight miles. Connection will be made with the Southern at Swannanoa. J. J. Dalton and S. F. Chapman, Asheville, N. C., are said to be interested. (March 25, p. 248.)

BUFFALO CREEK & GAULEY.—This company has been incorporated in West Virginia to build a railroad from Clay Court House southeast to Camden-on-Gauley, 30 miles. J. M. Cameron, J. Y. Boyd, and others, are incorporators.

DELAWARE, LACKAWANNA & WESTERN.—Press reports state that this company is considering the proposition of extending its Cincinnatus branch (formerly the Erie & Central New York) from Cincinnatus east to South Otselic, 20 miles. The Erie & Central New York was purchased by the Delaware, Lackawanna & Western in December, 1903. It runs between Cortland and Cincinnatus, 19 miles.

DENVER, NORTHWESTERN & PACIFIC.—The newspapers say that this road has been completed as far as Quartz Creek, 34 miles out of Denver. A bridge is now being built over Quartz Creek, and it is stated that work will be rapidly pushed towards Kremmling which is 130 miles from Denver. (See Construction Supplement.)

CANADIAN NORTHERN.—It is stated that work will soon be begun on an extension from Medford to Port Albert, 60 miles. It is also reported that an extension will be built from the present western terminus at Gilbert Plains west towards Edmonton, a distance of 200 miles.

CHATTANOOGA & AUGUSTA.—It is reported that surveys will soon be begun for this proposed road from Augusta northwest to Elberton, Ga., a distance of 70 miles. The company was incorporated several years ago, but no work of any consequence has ever been done.

CHERRY TREE & DIXONVILLE.—It is reported that this road, which is being built from Cherry Tree to Fleming Summit, Pa., will be extended to Possum Glory, 21 miles from Cherry Tree. Contracts for this extension are to be let at once.

CINCINNATI, BLUFFTON & CHICAGO.—A sub-contract has been awarded to Blogett & Co., of Newark, Ohio, for grading the extension of this road from Pennville, Ind., to Salamonia. The road was recently completed from Bluffton to Pennville, 19 miles, and will eventually be extended to Union City. A. T. Russell, Bluffton, Ind., is Chief Engineer. (See Construction Supplement.)

COAL & COKE.—An officer writes that a contract has been awarded to the Smith Construction Co., of Philadelphia, for grading nine miles of the Frenchton extension. W. H. Bower, Elkins, W. Va., is general manager. (April 8, p. 281.)

EASTERN IOWA (ELECTRIC).—Press reports state that surveys have been completed for this proposed electric railroad from West Liberty, through Iowa City to Muscatine. It is stated that grading will shortly be begun. A. F. Groeltz, Cedar Rapids, is president, and W. W. Chamberlain, secretary. (March 18, p. 222.)

EMORY VALLEY.—Surveys are reported in progress for this road which is projected from a point on the Chattanooga Southern in Hamilton County, Tenn., to a point a few miles south of Chattanooga. S. B. Cook, T. P. McMahon, M. N. Hope and others, of Chattanooga, Tenn., are interested. (See Construction Supplement.)

GILPIN & CLEAR CREEK.—A contract has been awarded to the Hall Construction Co. for building the first section of this railroad from a connection with the Denver, Northwestern & Pacific, at Pactolus, Colo., 28 miles west of Denver, to Central City, a distance of 25 miles. R. A. Hall, Central City, Colo., may be addressed. (April 15, p. 298.)

GRAND TRUNK.—Work has been begun for building a second track from London, Ont., to Paris, 70 miles, and it is stated that the work will be completed by the end of 1904. As soon as this stretch is finished there will only remain a short section between Paris and Brantford to be finished in order to give the Grand Trunk a continuous double track line between Montreal and Chicago, 840 miles.

GREAT NORTHERN.—It is stated that the tunnel which this company is building under Seattle, Wash., is about half completed and that it will be opened for traffic early in the fall. The tunnel is about one and one-half miles long and will connect with the new terminals which this company is building at Seattle. (See Construction Supplement.)

HAMMOND BELT LINE.—An officer writes that this company, which was recently incorporated, proposes to build a railroad eight miles long from Osborn, Ind., to Calumet Park, Ill. Surveys have been made from South Hammond, Ind., to Calumet Park, four miles, and grading will be begun at once. A. F. Knotts, Hammond, Ind., is interested. (April 8, p. 282.)

INTERSTATE.—This company has been incorporated in Missouri to build a railroad from Kansas City to Duluth, Minn., with a branch line from Marceline, Mo., to Coon Rapids, Iowa. The headquarters of the company will be at Kansas City, Mo. It is stated that surveys will shortly be begun.

IONE & EASTERN.—Incorporation has been granted this company in California to build a railroad from Ione through Jackson to Sutter Creek, 14 miles. J. J. Fagan, R. E. Wallace and H. H. Ferns are incorporators.

LAKE SHORE & MICHIGAN SOUTHERN.—Work has been started on four tracking at Erie. A new yard will be built at Erie just east of the Philadelphia & Erie crossing, and a fourth track will be built from Girard to Erie, Pa. A great number of the steel and iron bridges on the Eastern Division will also be supplanted by stone and concrete structures.

LEXINGTON SUBURBAN.—Articles of incorporation have been filed by this company in Missouri to build an electric railroad from Henry, in Ray County, through Lexington to Mayview, 25 miles. Connection will be made with the Chicago & Alton at the latter point. Gustav Haerle, Lexington, Mo.; A. G. Southerland, L. R. Ash and others, of Kansas City, are incorporators.

LOUISIANA CENTRAL.—A charter has been filed by this company in Louisiana to build a railroad from Monroe south to New Iberia, 180 miles. It is stated that grading will be begun on the first section before May 1. G. W. Decker, Newport, Ark., and Otto Mears, Marksville, La., are said to be interested.

MEXICAN ROADS.—It is reported that the Tula Iron Works Co. is about to build a railroad from Sayula to Antlan, in the State of Jalisco, 75 miles. Connection will be made with the Mexican Central at the former point.

A concession has been granted by the Mexican Government to J. W. Young, of Salt Lake City, for building about 1,500 miles of railroad in Western Mexico. The proposed road will connect Juarez, on the Texas State line, with Culiacan and other Pacific ports.

The Laredo Mining Co. is about to build a railroad from Saltillo to Bayones. C. C. Pierce, Laredo, Tex., may be addressed.

The Mexican Government has granted a concession to Sabastian B. de Mier, Mexican Minister to France, to build and operate a railroad from Hacienda de Atlamaxac, in the state of Puebla, to a point in the state of Tlaxcala, near Guadalupe, 50 miles. It is stated that surveys will be begun at once and that grading will be commenced as soon as the plans have been approved by the government.

The Mexican Government has granted a concession to Thomas McManus, of the Greene Consolidated Copper Co., for building and operating 250 miles of railroad in the northwestern part of Mexico. The main line will be built from a point near Naco to a point on the Mexican Central near the City of Chihuahua. A branch is also projected from a point on the Naco & Cannanea to a connection with the Sonora branch of the Southern Pacific.

MIDLAND VALLEY.—A contract is reported let to Maney Bros. for building an extension of this road from Muskogee, Ind. T., to Tulsa. From Tulsa, the line will eventually be extended to Wichita, Kan.

MISSISSIPPI & EASTERN.—Grading has been completed on this road between Quitman, Miss., and Carmichael, 12 miles, and two miles of track have been laid. The road is projected from Quitman to the Tombigbee River, 35 miles. Work is now in progress between Carmichael and Melvin, nine miles. J. W. Glynn, Quitman, Miss., is chief engineer, and C. F. Thompson is general manager. (See Construction Supplement.)

MISSOURI, KANSAS & TEXAS.—At a recent meeting of the directors of this company, it was voted to amend the articles of incorporation so as to provide for an extension from Guthrie or Oklahoma City through the counties of Logan, Canadian, Kiowa, Greer and Comanche to the dividing line between Texas and Oklahoma Territory, 150 miles. A coal road 35 miles long through the Osage nation was also authorized.

NEW YORK CENTRAL & HUDSON RIVER.—The Massachusetts Railroad Commission has approved plans for the abolition of all grade crossings in East Boston and Newton, Mass. The work of changing these grades must be undertaken by this company as lessee of the Boston & Albany.

NORTHEAST TEXAS.—It is stated that work will soon be begun on the remaining 40 miles of this road between Red Water, Tex., and Texarkana. The line is completed for a distance of 14 miles from Red Water south to Daingerfield. It is intended ultimately to extend the line to Houston or Galveston. G. Munz, Red Water, Tex., is president, and R. E. Gray is chief engineer.

PENNSYLVANIA.—Press reports state that this company is about to complete the work of double-tracking its Belvidere Division, which runs from Trenton, N. J., to Mannuka Chunk, 68 miles.

PLACERVILLE & LAKE TAHOE.—This company has been incorporated in California to build a railroad from Placerville, in El Dorado County to Pino Grande and thence to Tallac, 65 miles. J. H. Swift, J. D. Brown, S. J. Bassett, W. J. Barnett and others, of Placerville, Cal., are incorporators.

ROCHESTER, SYRACUSE & EASTERN.—Bids are now being asked by this company for grading the first section of its road. This portion will extend for a distance of 15 miles out of Rochester, N. Y. T. H. Mather, Syracuse, is chief engineer, and C. D. Beebe is president.

SNAKE RIVER R. R.—Articles of incorporation have been filed by this company in Oregon. It is proposed to build a railroad from Nagle, two miles east of Huntington, Ore., along the Snake River to Ballards' Landing, a distance of 75 miles. The line will connect with the Oregon Short Line at Huntington.

SOUTH DAKOTA CENTRAL.—An officer writes that a contract has been awarded to Fremont Hill to build this railroad from Sioux Falls, S. Dak., in a northwesterly direction for a distance of 20 miles. The line will eventually be extended to Madison, 40 miles from Sioux Falls. The character of the work is light, with 1 per cent. grade and easy curves. The above name is the correct title of this road which was reported in our issue of April 8 under the head of Sioux Falls & Colton. P. F. Sherman, Sioux Falls, S. Dak., is president.

TEXAS & PACIFIC.—Work has been begun by this company on a second track from Fort Worth, Tex., to Dallas, 32 miles. It is stated that the company is making this improvement so as to meet the competition of the Northern Texas Traction Co., which runs trains between these two cities every hour.

TOLEDO NORTHWESTERN (ELECTRIC).—Incorporation has been granted this company in Ohio to build an electric railroad from Toledo in a northerly direction through Lucas County. C. W. Merrill, H. C. Adams, R. W. Barton, and others, of Toledo, are incorporators.

TREMONT & GULF.—It is reported that this company is about to let contracts for the first eight miles of its extension out of Eros, La. The work will include several trestles. W. G. Collar, Tremont, La., is vice-president and general manager. (See Construction Supplement.)

WAPSIE VALLEY.—Articles of incorporation have been filed by this company in Iowa to build a number of electric lines from Independence, Iowa, in a northwesterly and northerly direction. H. J. Wyanhoff is president, and R. B. Raines, treasurer, both of Tripoli, Iowa.

WARE SHOALS.—A contract has been awarded to A. Bramlett and J. R. Gallagher, of Laurens, S. C., for building this railroad from Barmore to Ware Shoals, four miles. Grading will be begun at once. (See Construction Supplement.)

WEBSTER & VEBLEN.—Articles of incorporation have been filed by this company in South Dakota. It is proposed to build a railroad from Webster, in Day County, to Veblen, in Marshall County, 50 miles. The headquarters of the company will be at Grenville, S. Dak. R. O'Conner and F. A. Dabney, Grenville, S. Dak., are among the incorporators.

GENERAL RAILROAD NEWS.

BALTIMORE & OHIO.—This company has sold $10,000,000 two year 4½ per cent. notes to Kuhn, Loeb & Co. and Speyer & Co. The notes are secured by collateral consisting of first and second preferred stock of the Reading Co. The proceeds from the sale will be used to take up $2,500,000 Staten Island Rapid Transit second mortgage bonds and to pay for new construction and equipment.

CHICAGO, ROCK ISLAND & PACIFIC.—This company has entered into an agreement with the Kansas City Belt Line for the use of the latter's tracks and terminals in Kansas City. It is stated that the Kansas City-Trenton cut-off of the Chicago, Rock Island & Pacific will be completed in May and that trains will then be run in over the tracks of the Belt Line.

GURLEY & PAINT ROCK VALLEY.—The property of this company was sold at auction on April 5 under a decree of the Chancery Court of Jackson County, Ala. It was bought by M. A. Clay, of Princeton, Ala., for $18,000. The line was originally projected from Gurley, Ala., to Winchseter, Tenn., and a part of the line was graded several years ago, but no track has been laid.

KANSAS BELT.—See Chicago, Rock Island & Pacific above.

LOUISIANA & ARKANSAS.—See St. Louis & San Francisco, below.

MAUCH CHUNK, LEHIGHTON & SLATINGTON STREET.—This company, which has been in the hands of a receiver for about six months, was sold at auction on April 12. The price paid was $150,000 and the property was purchased by a committee representing the bondholders, composed of J. M. Dreisbach, Mauch Chunk; M. C. Trexler, Allentown, and Thomas Keck.

NATIONAL OF MEXICO.—The report of this company for the year ending December 31, 1903, shows gross earnings of $11,344,000, an increase of $2,081,159. Operating expenses increased $1,585,000, leaving an increase in net earnings of $495,000. On a gold basis, the net earnings would amount to $1,562,085, an increase of $233,657 over 1902. The balance for the year amounted to $108,730, Mexican currency, or $141,674 on a gold standard. The large increases in operating expenses were due to a heavy increase in traffic and also to the work of changing the gage between Laredo, Texas, and the City of Mexico. It is officially stated that the receipts for the transportation of construction material represent less than half the increase in earnings.

NEW YORK, NEW HAVEN & HARTFORD.—This company has sold $7,500,000 4 per cent. 50-year gold bonds of the Harlem River & Port Chester Railroad, the buyers being Kidder, Peabody & Co., of Boston, and Estabrook & Co., and R. L. Day & Co., of New York. The price paid for the bonds is not stated. The proceeds will be used to redeem the $3,000,000 funded debt on the property and to pay for four-tracking and other improvements on the line, which is the Harlem River Branch.

NORFOLK & WESTERN.—This company has sold to Kuhn Loeb & Co., $2,000,000 four per cent. equipment notes. These notes are in a serial form and run from one to ten years.

OAKLAND, CHARLESTON & WESTERN.—This company has filed a mortgage for $200,000 with the Memphis Trust Co., Memphis, Tenn., as trustee. The company was recently incorporated to build a road from Oakland, Miss., to Charleston. J. H. Larimer, Charleston, Miss., is President.

READING COMPANY.—At a recent meeting of the directors of this company a semi-annual dividend of 2 per cent. was declared on the second preferred stock. This dividend is an increase of ½ per cent. over the dividend which was paid in November of last year. The new dividend is payable May 10 to stockholders of record of April 22. The Reading Co., for the eight months ending February 29, 1904, showed a surplus above all charges of $4,645,322, as compared with $1,732,291 for the corresponding eight months of last year. The Baltimore & Ohio and the Lake Shore & Michigan Southern each own $13,990,000 of the second preferred stock of the Reading Co.

ST. LOUIS & SAN FRANCISCO.—It has been announced that this company secured control some time ago of the Louisiana & Arkansas, which runs from Hope, Ark. to Jena, La., 175 miles; and that the company will build a line from Memphis, Tenn., through Marianna to Baton Rouge, connecting at some point near Jena with the L. & A. This will give a low-grade line from St. Louis to New Orleans by means of a connection with the Yazoo & Mississippi Valley at Baton Rouge.